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ABSTRACT

Five studies investigated the development of imitation in children 1-3 years old. Results indicated that children as young as 12 months possess the cognitive capability of translating a perception of an action into their own behavior, but imitation varies as actions requiring direct social commerce with the examiner are imitated less frequently than simple motor behaviors with objects. Moreover, imitation depends upon the child's cognitive development. For example, coordinated sequences of behaviors are not imitated until entity-entity relationships are possible, and deferred imitation requires the advent of symbolic relations. There is no evidence in this research for a trait of imitativeness, at least not until symbolic relations are involved. While children under 2 years of age are not facile at imitating sequences of behaviors or delaying performance a short time after modeling, older toddlers will imitate televised sequences even after a 24-hour delay. Whereas socially extroverted and fearless children imitate live models more than shy children, TV imitation does not appear to be related to temperament, home TV-viewing habits, or parental education. Finally, reciprocal imitation games between parent or peer and the infant may promote the infant's social cognition of influencing another person at a distance. (Author/MS)

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FINAL REPORT

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The Development of Imitation in Children 1-3 Years Old

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Yellow Springs, Ohio

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Imitation of Live and Televised Models in Children 1-3 Years of Age

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Abstract

The results of five studies indicated that children as young as 12 months possess the cognitive capability of translating a perception of an action into their own behavior, but imitation varies as actions requiring direct social commerce with the examiner are imitated less frequently than simple motor behaviors with objects. Moreover, imitation depends upon the child's cognitive development. For example, coordinated sequences of behaviors are not imitated until entity-entity relationships are possible, and deferred imitation requires the advent of symbolic relations. There was no evidence for a trait of imitativeness, at least not until symbolic relations are involved. While children under two years of age are not facile at imitating sequences of behaviors or delaying performance a short time after modeling, older toddlers will imitate televised sequences even after a 24-hour delay. Whereas socially extroverted and fearless children imitated live models more than shy children, TV imitation was not related to temperament, home TV viewing habits, or parental education. Finally, reciprocal imitation games between parent or peer and the infant may promote the social cognition influencing another person.

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CHAPTER 1: INTRODUCTION

Recently our views concerning the way in which children's intellectual skills and social behaviors are acquired, modified, and maintained have undergone some revision. A major feature of this reorientation is the increasing emphasis on the role of imitation or observational learning in the child's intellectual and social development. Historically, most research in this area has been concerned with social and personality development. Now, however, emphasis is shifting toward the recognition that imitative processes may affect intellectual development as well. For example, modeling principles have been implicated in such diverse cognitive and intellectual behaviors as syntactic style (Bandura & Harris, 1966; Odom, Liebert, & Hill, 1968), numerical concepts (Zimmerman & Rosenthal, 1973), Piagetian conservation tasks (Sullivan, 1967), cognitive style (Denney, 1972; Debus, 1970; Ridberg, Parke, & Hetherington, 1971), and question-formulation behavior (Rosenthal & Zimmerman, 1973).

Although observational learning and imitation influence a great variety of important behaviors in children, relatively little attention has been paid to the development of imitative processes per se, and very few studies have investigated these behaviors in children younger than three years of age. Research is needed to detail the manner in which imitative processes undergo ontogenetic change during the first three years of life. Therefore, one major goal of the present monograph is to provide basic information concerning the development of imitation in 1-3 year old children.

From a practical standpoint, the success of Sesame Street and the results of other research illustrate the profound impact observational learning from filmed and televised models can have on the acquisition of basic cognitive and educational skills of enormous numbers of American children (Ball & Bogatz, 1972; Bandura, 1972; Lesser, 1974). Although most educational television programs are directed at children five years of age and older, many of the elementary concepts presented by these TV curriculums (e.g., counting, shape identification, the alphabet) potentially could be acquired by much younger children. Moreover, advertisers (e.g., toy manufacturers, cereal and other foodstuff producers occasionally aim their commercial messages at youngsters under 5-6 years of age. Although precise statistics are not available, we speculate that the TV audience of 2- to 3-year-olds for these materials is substantial, especially among those toddlers who have older siblings who watch such programs. Therefore, a second major feature of this project is to investigate the potential of very young children to imitate a televised model and to study the possible role of certain demographic and procedural parameters in such behavior.

Literature Resumé

The very brief literature on imitation and observational learning in the first years of life has addressed three general questions: (1) the age of onset of imitative behavior, (2) developmental change in the capacity to accurately imitate, and (3) parameters and correlates of early imitation.

How Early?

Much of the literature represents an attempt to determine the earliest age at which infants will imitate some behavior. The first reports told of individual infants who imitated mouth and tongue movements in the second month of life (Brazelton & Young, 1964; Gardner & Gardner, 1970). Not only was this a surprisingly early age, but Piaget (1951) had suggested that the capability to imitate actions that infants could not observe in their own behavior (e.g., infants cannot visually monitor their own tongue protrusion) was not available until 9-10 months of age. Therefore, the mechanism for translating a perceived action into one's own motor behavior seemed to be a basic function available in the first months of life.

Subsequent studies using larger samples and a greater variety of behaviors support this inference. Lyakh (1968, as cited by Razran, 1971) reported imitation of adult mouth movements in 2- to 4-month-old infants, Maratos (Note 1) observed similar imitation in infants as young as one month, and Kaye and Marcus (Note 2) found vocal imitation in 6- to 7-month infants. Even more dramatic is the recent demonstration by Moore & Meltzoff (Note 3) of imitative lip protrusion, mouth opening, tongue protrusion, and finger movement in two-week-old infants.

Developmental Course

How does the ability to imitate and learn through observation change over age?

Changes in what can be imitated. Piaget (1951), who was influenced by Guillaume (1926) and Valentine (1930), offered the most complete theoretical description of the development of imitation during infancy. From Piaget's perspective, the ontogeny of imitative behaviors is directly tied to the child's cognitive development. For example, prior to approximately 7-8 months, infants are essentially incapable of distinguishing entities in the environment from their own actions with or perceptions of them. Therefore, it is nearly impossible for an infant to imitate a new behavior observed in another, because such an act cannot be separated from its perception.

However, as described above, imitation does occur before 7-8 months, but only well-practiced actions currently available in the infant's response repertoire--not novel actions--are "imitated." Piaget (1951) called this phenomenon "pseudoimitation" and Aronfreed (1969) labeled it "social facilitation." The skimpy empirical data conform to this postulate (Abravanel, Levan, & Stevenson, Note 4; Hursh & Sherman, 1973; Litrownik, 1972; Webb & Massar, Note 5; Uzgiris, 1972). Basically, then, prior to 7-8 months, imitation is really response facilitation; the imitation of novel behaviors does not typically occur until after this point, and it is a capability reserved for only the highest animal species (Hall, 1963).

At approximately 7-8 months, infants begin to distinguish entities and events in the environment from their perception of or action with them. Therefore, the imitation of simple novel behaviors should

begin at approximately this time, culminating at approximately 13 months when means and ends are completely separable. However, because the infant is not yet capable of symbolic relations between objects or events, the child under approximately 18-21 months is not able to imitate behaviors involving a sequence of several discrete acts and cannot delay the performance of even elementary behaviors too long following the modeling presentation. When symbolic relations are achieved near the end of the second year, the toddler will be able to encode relationships between entities and events, which permit the display of imitative behavior long after the model has departed. Piaget (1951) called the ability to delay performance "deferred imitation" and considered its occurrence a major sign that the child has attained the rudimentary aspects of symbolic functioning.

Changes in the accuracy of imitation. Researchers who have pioneered the study of imitation in the first year of life (e.g., Kenneth Kaye and Ina Uzgiris) feel that the accuracy of imitative behavior also changes over age. At first, the infant may follow each of several modeling presentations by performing some behavior, but that behavior might bear no qualitative similarity to the modeled action. Later, approximations to the target behavior may appear, such as, lip movements rather than actual vocalizations. Subsequently, progressive approximations and finally perfect reproduction of the target behavior will be seen. Unfortunately, such a progression has only been described in relatively informal terms (Kaye, Note 6; Uzgiris, 1972).

Parameters of Imitation in Infancy

The limited research data available on imitation in the first three years of life suggest a few parameters of the likelihood of imitation.

Imitation, especially early in life, depends on the nature of the behavior to be imitated (e.g., Abravanel et al., Note 4; Maratos, Note 1; Webb & Massar, Note 5). For example, Maratos (Note 1) investigated the development of imitation from 1 to 6 months of life for several simple behaviors--tongue protrusions, mouth opening and closings, finger movements, moving hands together, side to side head movements, and syllable vocalizations. Age trends varied as a function of the type of modeled behavior. Tongue protrusions and mouth movements were frequent at one month and decreased to a sporadic level by two and a half months. Similarly, imitative head and leg movements showed a slower, but nevertheless steady decline across the first 4 months. In contrast, finger and arm movements as well as vocalizations increased in frequency across the 6-month age span. Therefore, developmental changes in imitative behavior may vary with the qualitative nature of the behavior being imitated.

Other aspects of the target behavior have influenced imitation. Piaget (1951) suggested that behaviors which infants visually observed in another person but could not watch themselves perform (e.g., tongue protrusion) are more difficult than actions which infants can visually monitor in their own behavior. The data reveal that even very young

infants imitate invisible actions (as reviewed above), but the frequency is less than for visible behaviors (Abravanel et al., Note 4). Imitation of gestures is more likely, especially at young ages, than imitation of vocalizations (Paraskevopoulos & Hunt, 1971; Rodgon & Kurdek, Note 7; Uzgiris, 1972), and gestures with objects are imitated more frequently than gestures without objects (Abravanel et al., Note 4; Rodgon & Kurdek, Note 7; Uzgiris, 1972). Finally, children in the second year of life will imitate simple, single-unit behaviors more readily than sequences of discrete acts, and they may be more likely to imitate when there is some cognitive uncertainty about what to do with an object or how to solve a problem (Webb & Massar, Note 5).

Generally, only very modest or zero-order correlations of the likelihood of imitation across different tasks have been observed prior to approximately 20 months of life (Abravanel et al., Note 4; Rodgon & Kurdek, Note 7; Webb & Massar, Note 5). However, Rodgon and Kurdek (Note 7) did find a high correlation between the propensity to imitate sounds and word combinations and spontaneous vocabulary at 20 months of age. Perhaps individual differences become more consistent when symbolism becomes a part of the imitative behavior.

Overview of the Monograph

A series of studies will be described that provides information concerning the developmental course of imitation between one and three years of life. First, data from the Fels and Berkeley longitudinal studies will be presented in order to assess the developmental changes

in imitative behavior on infant tests in the 12- to 18-month age period. Next, a cross-sectional and longitudinal description of imitation in 12-24-month old infants is reported. Potential relationships were examined between immediate and deferred imitation and the type of imitative behavior, sex of infant, examiner, socioeconomic class, and presence of siblings. In the third and fourth investigations, live and televised models were compared across the 18-36-month age period with particular attention to the deferred imitation effect. The possible association between viewing history and temperament on the one hand and imitation on the other was also examined. Finally, the impact of being imitated on the child's social behavior was explored in a fifth experiment. Collectively, these data provide the beginning of a systematic description of imitation in the 1-3-year old child.

CHAPTER II. IMITATION OF LIVE MODELS

Wohlwill (1973) and later McCall (1976-a) have suggested that psychologists should spend more time describing the general area of research interest before launching into focused experimental studies. This chapter reports two attempts to descriptively chart the nature of imitative behavior in infants using a live model.

Experiment 1: Imitation on Infant Tests of Mental Performance

Initially one might wonder if there is a general trait of "proneness to imitate" in infants that governs behavior across a variety of modeled actions and ages. If the evidence for a trait of imitativeness were weak, then one would be encouraged to systematically explore parameters of the modeled behavior and developmental transitions in the nature of imitative responses.

Items on infant tests frequently require the examiner to model a behavior for the infant who then must imitate it to gain credit. The Fels and Berkeley studies provided two major longitudinal data bases in which infant test protocols could be examined for a trait of imitativeness. But, these data were as limited as they were convenient. For example, one cannot be sure that the behavior displayed by the infant on a given item was unequivocally imitation. In the context of mental testing, the examiner often verbally requests the child to perform a given action, encourages the infant to do so, and may even reward approximations. Moreover, the infant is not typically given a chance to play with the test materials during which time the infant might spontaneously display the target behavior without ever seeing it modeled.

Despite these concerns, the analyses of the Fels and Berkeley data bases were pursued for several reasons. First, the data were available and already collected, affording a considerable measure of economy. Second, these data were longitudinal, and the stability of any trait of imitativeness could be assessed. Third, the infant testing situation was known to produce imitative-like behavior from infants of the ages we wished to study. The research strategy adopted for this project was to begin to assess imitation in infants in a context known to produce it in some form. The analysis of responses to traditional infant test items apparently requiring an imitative response of some sort was a logical place to begin, despite the lack of precise operational definitions and procedural rigor which the project ultimately pursued. Once basic descriptive information was acquired, more systematic and ecological studies would be attempted.

Gesell Protocols from the Fels Longitudinal Study

Items on the Gesell infant test that appeared to require the subject to imitate the examiner's behavior were selected and the responses of infants from the Fels Longitudinal Study were analyzed with several questions in mind: To what extent are the responses infants make to different imitation-like items correlated with one another? Is there a single dimension of imitativeness underlying these different items? Are there correlations across age in the infant's propensity to imitate? Are there differences attributable to sex, socioeconomic class, and the presence of siblings?

Method

Subjects. Subjects included all infants in the Fels Longitudinal Study who had a complete set of responses at 12 or at 18 months of age. Although the sample included some siblings, no multiple births or children with abnormalities were involved. The Fels population has been described in detail by others (Sontag, Baker, & Nelson, 1958) and consists of individuals from a wide variety of socioeconomic classes who tend to have above average childhood IQs (Binet IQ = 118, depending on age) but normal variability (SD = 17). The sample analyzed in the present report consisted of 118 males at 12 months and 95 males at 18 months, 94 of which contributed data at both ages. In addition, there were 104 females at 12 months and 84 at 18 months, 79 of which contributed data at both ages.

Gesell imitation-like items. Items on the 12- and 18-month Gesell tests were selected as being "imitative-like" if two research assistants agreed that a specific behavior was modeled by the examiner and passage of the item required that the infant duplicate the examiner's behavior. If fewer than 5% or more than 95% of the subjects of either sex passed the item at a given age, it was not included in the analysis (this criterion eliminated two items at 18 months). A description of the items qualifying for analysis is presented in Table 1.

Insert Table 1 about here

Table 1. Gesell "Imitation" Items Used for Analysis of Fels Data

12 Months

1. Tower, 2-3 blocks (A23) -- The examiner builds a tower of three blocks and requests verbally and with gestures for the child to build a tower of two (1 point) or three (2 points) blocks.
2. Circle in formboard (A52) -- After the child has time to spontaneously place the circle in a formboard with openings for a circle, square, and triangle, the examiner demonstrates putting the circle in its place and credit is given for imitation.
3. Scribbles (M40) -- The examiner scribbles on a sheet of paper with a crayon and encourages the child to imitate with gestures and words.
4. Rattles spoon in cup (A20) -- The examiner rattles a spoon in a cup and waits for the child to imitate.
5. Rings bell (A21) -- Examiner rings a bell and then gives it to the child to see if he rings it purposively.
6. Hits Doll (A22) -- Examiner hits a rubber whistle-doll producing a sound in response and then presents the doll to the child for imitation.

18 Months

1. Triangle in formboard (A52) -- After being shown the circle, the triangle is also demonstrated and credit given for imitatively placing it in the formboard.
2. Tower, 3-4 blocks (A23) -- Same as 12-month item but child gets 1 point for a tower of three and 2 points for a tower of four.

Table 1 (continued)

3. Drawing (M40 to M42) -- After a time for spontaneous scribbling, the child receives one point for imitating each of the following: random scribbling, single stroke, differentiation of stroke from scribbling, vertical line, and horizontal line.
4. Repeats things said (L40) -- by actual trial or interview, does the child repeat more than two words or phrases said to him by the examiner or mother?
5. Hits doll (A22) -- same as 12-month item
6. Folds paper (A27) -- The examiner folds a piece of paper once and repeats the action several times. Then the child is given a new sheet of paper and the examiner says, "You make one like this."

Results

Item intercorrelations. The first question was the extent to which the infant's behavior on one item was related to success on another. Item scores were intercorrelated separately for each sex within each age. Generally, these correlations were very low, and the highest r for each of the four correlation matrices (males and females at 12 and 18 months) ranged between .21 and .32. Except for the older females, the responses to most items correlated less than .10 with each other. This result tentatively suggests that there may not be much cohesiveness in the infant's propensity to imitate different types of behavior, either as a function of item unreliability, variability in the age appropriateness of different items, or the contrasting nature of the behaviors to be imitated.

Factor analyses. If the low correlations were attributable to different aspects of the specific behaviors modeled, then one might expect relatively more association of individual differences in the responses to items that are similar to one another with respect to that parameter. Therefore, a principal component factor analysis with a Varimax rotation of factors with eigenvalues of 1.0 or greater was performed separately for males and females at each age on the responses to the items listed in Table 1. The first principal component accounted for between 22 and 28 percent of the variance for the four groups, while the second component was associated with 18-23 percent. Two Varimax factors were considered for each group at each age, and the loadings of

Table 2. Varimax Factor Analysis of "Imitation" Items on the Gesell for the Fels Data

Loadings (>.40)

	Males (N=118)		Females (N=104)	
12-Month Items	I	II	I	II
Tower, 2-3 blocks		.77	.74	
Circle in formboard		.69	.74	
Scribbles		.42	.59	
Rattles spoon in cup	.82			.81
Rings bell	.75		.41	.49
Hits doll				.64

	Males (N=95)		Females (N=84)	
18-Month Items	I	II	I	II
Tria e in formboard		.70	.70	
Tow 3-4 blocks		.51	.61	
Dra	.70		.54	
Repe s things said	.78			.60
Hits oll		-.64		.67
Folds paper				.64

the items on those factors are presented in Table 2.

Insert Table 2 about here

The Varimax rotation to simple structure will produce a solution in which each item is maximally loaded on one factor and minimally loaded on all others. Therefore, separable dimensions of behavior can be described even when the matrix being factored contains very low correlations. At 12 months, there was a tendency for the two factors to be defined as a function of the stimulus characteristics and perceptual consequences of the behavior being modeled. The six items factored into two sets, those on which the child imitates a behavior that results in a configural product (e.g., building a tower of blocks, placing the circle in the form board, and scribbling) versus a behavior that produces a sound (rattling a spoon, ringing a bell, hitting a whistle doll). This pattern emerged for both sexes, although the order of factor extraction differed for males and females.

At 18 months, a similar pattern occurred for females with the exception of the paper folding item which was loaded with the sound production behaviors. The data for males were less clear, but the bipolar second factor at 18 months may have pointed out the form versus-sound-production distinction by assigning a negative weight to hitting the whistle doll.

These data tentatively suggest that the infant's tendency to imitate one behavior versus another may be related to the nature of the target behavior. Superficially, individual differences coalesced around items

in which the target behavior produces a sound and around items in which it produces a configural product. However, the underlying theme may be the distinctiveness of the perceptual consequences to the target behavior rather than the modality of that consequence--the sound events are more distinctive than the form products.

Cross-age stability. Individual items as well as factor scores were correlated between 12 and 18 months. The size of these correlations, whatever their statistical significance, was modest. For males, scores on 12-month Factor I correlated .21 ($p < .05$) with 18-month Factor II, reflecting a very slight developmental consistency between the sound related items at 12 months and the sound-versus-form factor at 18 months. For females, scores on 12-month Factor I correlated .27 ($p < .02$) with the 18-month Factor I, revealing modest consistency in the imitation of form-product items. Cross-age correlations for individual items did not exceed these values. Therefore, longitudinal stability between 12 and 18 months of imitative behavior exists, but it is not impressive. If these samples had been half their actual size, no correlations would have been significant.

Relationships with parent education. The responses to individual items as well as Varimax factor scores were correlated with the education scale of the Hollingshead's two-factor index of social position in which a 7 indicated the highest level of education (Hollingshead, Note 8). Only three correlations from the four sets were statistically significant, and no correlation exceeded .25. Therefore, there is relatively little general relationship between parent education and perfor-

mance on these items or factor scores. This result is not surprising, since there is no correlation between socioeconomic class and total score on infant tests at these ages (McCall, 1976-a, Note 9; McCall, Hogarty, & Hurlburt, 1972).

Relationships with siblings. Another variable of potential interest was the presence of older siblings. One might imagine that infants having older brothers or sisters would have more models and ones who are more similar to themselves than would infants who had no older siblings. Consequently, infants were divided into those who had no older siblings and those who had at least one older sibling, and the mean factor scores for these two groups were compared within each age and sex category. The results are presented in Table 3.

Insert Table 3 about here

There were significant differences for the presence or absence of siblings for one factor at each age for both male and female infants. For 12- and 18-month males, infants having some older siblings scored higher on an imitation factor whereas female infants having some older siblings scored lower on certain factors. Specifically, males with siblings scored higher on Factor 1 (sound production at 12 months) and on Factor 2 (differentiation between form and sound production at 18 months). In contrast, females at both 12 and 18 months who had older siblings scored lower on the sound production factors.

Was the sibling effect greater as a function of the age of the older siblings? Infants were divided into those who had siblings that were 0-3, 3-6, or more than 6 years older than the infant subject.

Table 3. Mean Differences on Gesell "Imitation" Varimax Factors as a Function of the Absence or Presence of Older Siblings for the Fels Data

	Male Infants			Female Infants		
	No Sibs	Some Sibs	F	No Sibs	Some Sibs	F
12-Months						
Factor I	-.26	.14	4.51(1/116)*	.14	-.07	<1
Factor II	.09	-.05	<1	.33	-.16	5.67(1/102)*
18-Months						
Factor I	.17	-.09	1.39(1/93)	.07	-.03	<1
Factor II	-.45	.23	10.94(1/93)***	.32	-.15	4.35(1/82)*

* $p < .05$

*** $p < .001$

Because an infant could have a sibling in more than one age category, none/some sibling analyses were carried out separately for each of the three age-of-sibling categories. With only one exception, the effect for the presence or absence of siblings was greatest when the brother or sister was 3-6 years older than the subject (the exception was for 18-month males where the effect was greatest if the child had siblings in the 0-3-year-older category).

Therefore, these data tentatively indicate that the presence of a sibling, especially one 3-6 years older than the 12-18-month infant, may be associated with the infant's propensity to imitate sound product items in the mental test situation, but the specific direction of the effect may be opposite for male and female subjects.

California Test Protocols from the Berkeley Growth Study

The Berkeley Growth Study, under the direction of Dr. Nancy Bayley, administered the California First Year and California Preschool Scales, precursors to the contemporary Bayley infant test, to their subjects every month for the first 15 months of life. Thus, while the Fels data have the advantage of relatively large sample sizes, the Berkeley data have the asset of frequent testing.

Method

Subjects. Complete data were available on a maximum of 26 males and 28 females, although the actual N varied from month to month. Details of this sample have been reported by Bayley and Jones (1937) and by Bayley (1949, 1970).

Imitation-like items. Items were selected in the same manner as reported above for the Gesell tests. Analyses were carried out only at ages where at least five imitation items existed with more than 5% and less than 95% of the subjects answering each item correctly. Sufficient data were available at each month between 9 and 14 months, inclusive.

The definitions of the items selected as reflecting imitation are given in Table 4. Since these items were age scaled and testing begun

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Insert Table 4 about here

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at different points in the set of items from one infant to the next, all items below an infant's basal level were scored as correct and those beyond the highest level of achievement were considered incorrect.

Results

Items were subjected to a principal components factor analysis with Varimax rotation of components having eigenvalues greater than 1.0 separately for each sex at each age. Factor scores from two factors at each assessment were related across age.

The item composition of the obtained factors as well as the significant correlations across age are presented in Table 5 separately for

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Insert Table 5 about here

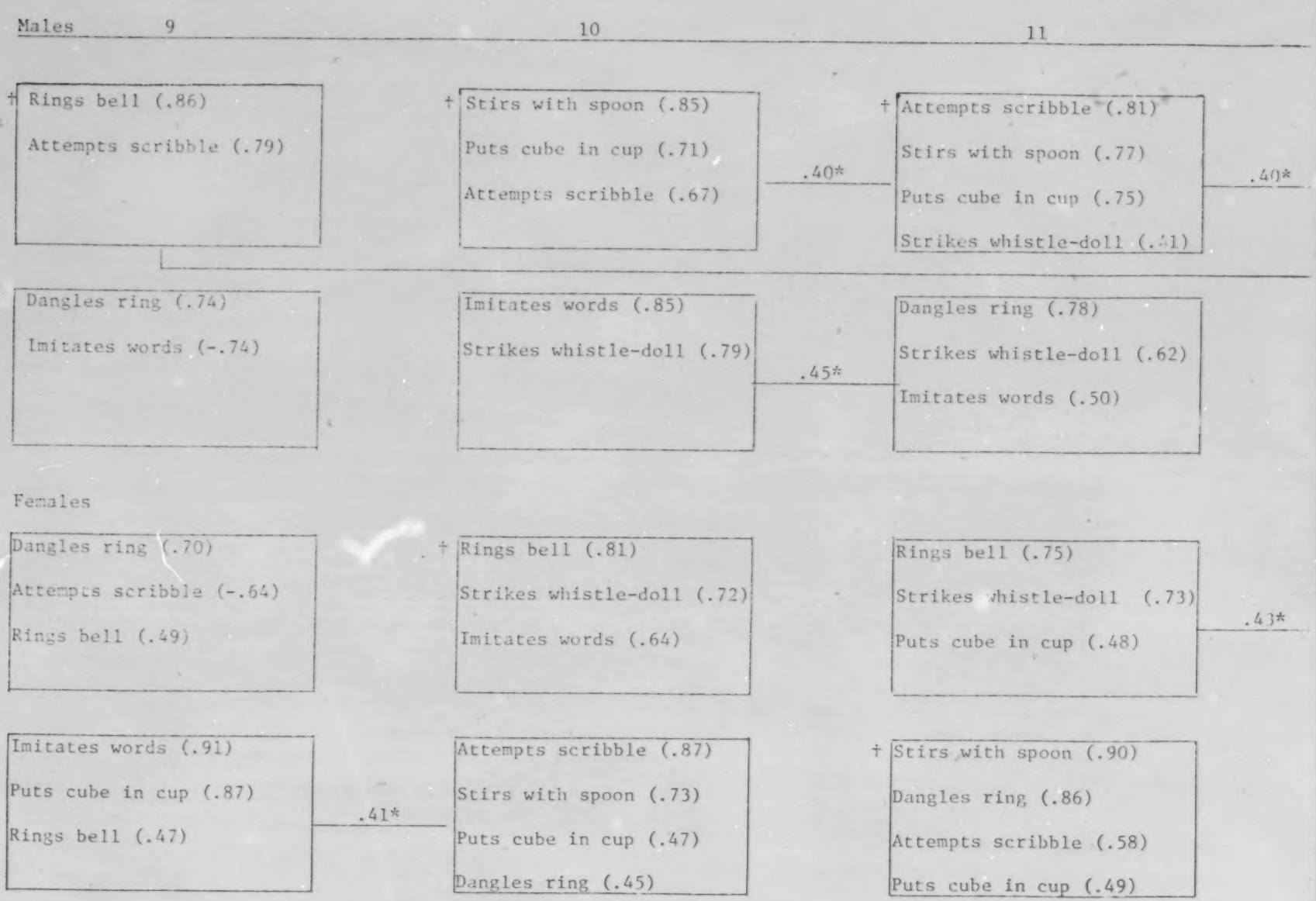
---

males and females. The results indicate several trends. First, despite the small number of subjects, reasonable consistency exists in factor

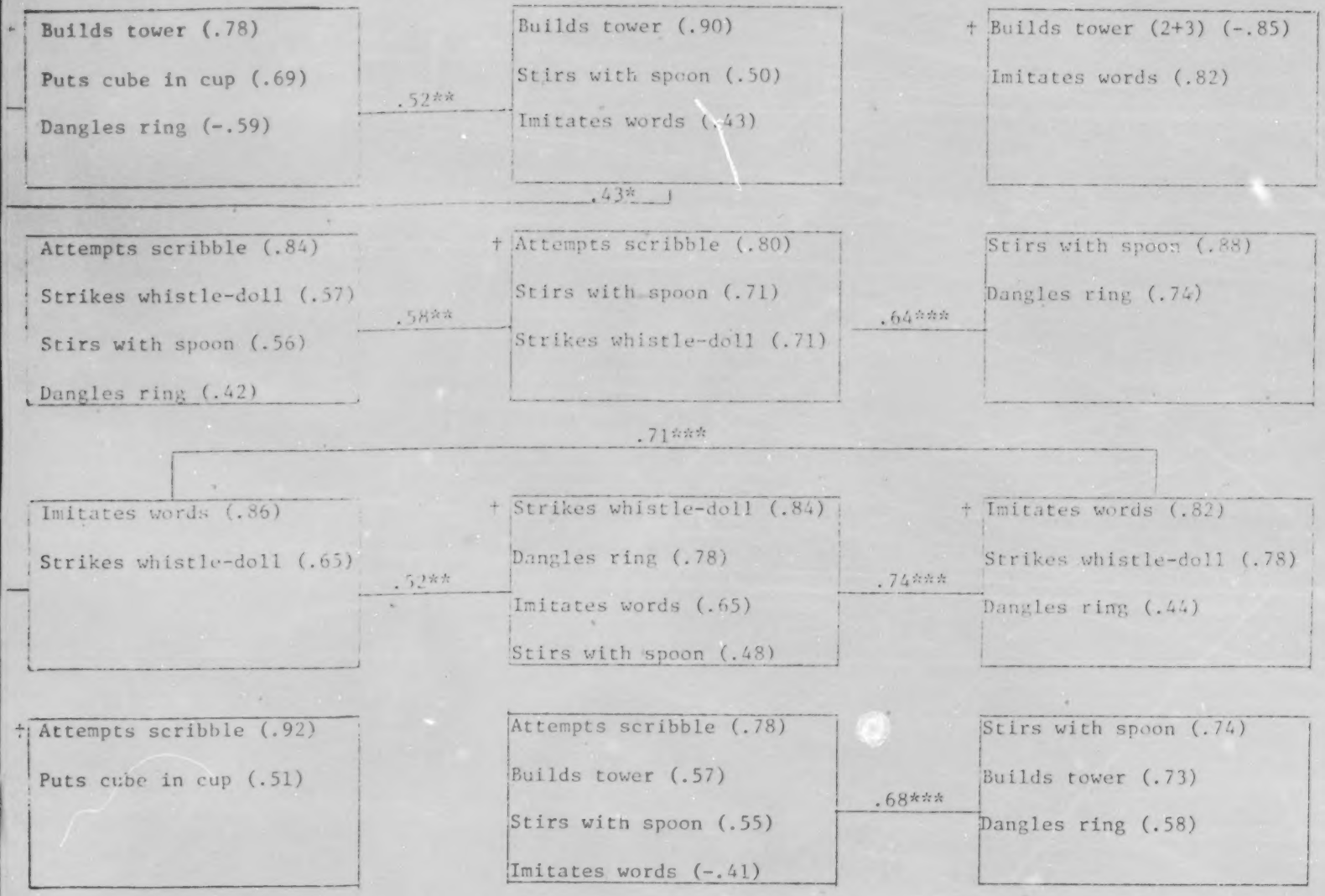
Table 4. "Imitation" Items Used for Analysis for the Berkeley Data

1. Rings bell (9.9 mo.) -- The examiner rings a bell and then gives it to the child to see if he rings it purposively.
2. Puts cube in cup (10.4 mo.) -- The examiner places a cube in a cup and then offers these materials to the child, encouraging him to imitate.
3. Attempts scribble (10.4 mo.) -- The examiner scribbles on a sheet of paper with a crayon and then offers the materials to the child, encouraging him to imitate (one point). Then the examiner makes a distinct stroke and another point is given if the child differentiates in his behavior the stroke from the scribble.
4. Strikes whistle-doll (11.6 mo.) -- Examiner hits a rubber whistle-doll making it squeek and than offers it to the child, encouraging him to imitate.
5. Imitates words (11.7 mo.) -- The examiner says several words, such as mama, dada, baby, etc., and tries to get the child to imitate them.
6. Stirs with spoon (12.1 mo.) -- The examiner rattles a spoon in a cup with a stirring motion and waits for the child to imitate motion (but not necessarily the noise).
7. Dangles ring (13.1 mo.) -- The examiner dangles a large ring by an attached string, then offers it to the child and waits for him to dangle it in imitation.
8. Builds tower (13.6 mo.) -- The examiner builds a tower of three blocks and encourages the child to build a tower of two (1 point) or three (2 points).

Table 5. Varimax Factors and Cross-Age Correlations for the Berkeley Data



* $p < .05$, ** $p < .01$, *** $p < .001$, † first varimax factor


Builds tower (.78)
Puts cube in cup (.69)
Dangles ring (-.59)
.52**
Builds tower (.90)
Stirs with spoon (.50)
Imitates words (-.43)
.43*
† Builds tower (2+3) (-.85)
Imitates words (.82)
Attempts scribble (.84)
Strikes whistle-doll (.57)
Stirs with spoon (.56)
Dangles ring (.42)
.58**
† Attempts scribble (.80)
Stirs with spoon (.71)
Strikes whistle-doll (.71)
.64***
Stirs with spoon (.88)
Dangles ring (.74)
.71***
Imitates words (.86)
Strikes whistle-doll (.65)
.52**
† Strikes whistle-doll (.84)
Dangles ring (.78)
Imitates words (.65)
Stirs with spoon (.48)
.74***
† Imitates words (.82)
Strikes whistle-doll (.78)
Dangles ring (.44)
† Attempts scribble (.92)
Puts cube in cup (.51)
Attempts scribble (.78)
Builds tower (.57)
Stirs with spoon (.55)
Imitates words (-.41)
.68***
Stirs with spoon (.74)
Builds tower (.73)
Dangles ring (.58)

composition both across age for the same subjects and across sex at the same age. Longitudinal stability begins at approximately 10 months and is somewhat more obvious for females than males.

Second, the tendency observed in the Fels data for items to cluster as a function of the stimulus consequence of the target behavior could again be seen in these data, especially at 10 and 11 months for males and at 10-14 months for females. Moreover, there is a suggestion that the interpretation based upon the clarity of stimulus consequences rather than their modality may be most appropriate. Two items on the California test not included on the Gesell showed an interesting pattern of loadings in this regard. Stirring a spoon in a cup easily could be conceived as either a form or a sound product item (because a correct response did not require the child to make a sound), and this item frequently loaded on both the predominantly sound or form-product factors (e.g., at 13 months). More telling, however, was the fact that the dangling ring item, which presumably involves no sound but can produce distinctive feedback to the infants manipulation, loaded on sound- as well as form-product factors (e.g., 11 and 14 months). The pattern of loadings for these items appears more consistent with the notion that the salient theme is the clarity and distinctiveness of the perceptual consequence to the target behavior rather than whether that consequence was visual or auditory.

A third result in Table 5 is the presence of marked short-term consistencies in individual differences across age. That is, a child's relative standing on a factor at one age often correlated with standing

on a similar factor at an adjacent age, and these correlations were quite high between 12 and 14 months. In fact, in some cases these correlations approach the size of cross-age relationships for the total score on the Bayley infant scale (Bayley, 1933). It should be noted that substantial relationships are found for time intervals of only a few months; the Berkeley data are consistent with the results of the Fels analyses in indicating a lack of stability in individual differences across epochs of 3+ months.

Conclusions

The Fels and Berkeley data are rather concordant in the general nature of their results. There does not appear to be a pervasive trait of imitativeness characteristic of infants between 9 and 18 months of age. That is, behavior on one instance of possible imitation is not highly correlated with behavior on another, and while there may be stability of individual differences in imitative behavior in the infant testing situation across one or two months, correlations are typically below .20 for longer spans of time.

Accepting the definition of imitation inherent in these mental test items and these correlational results, one might infer that whether or not an infant imitates a given behavior in this context is dependent on exogenous rather than endogenous factors. When forced to a solution through Varimax rotation, the data do suggest that one such parameter might be the distinctiveness of the stimulus consequence produced by the target behavior. Modeled acts which result in a clear perceptual

consequence (e.g., produced a sound) cluster together and responses to items which produce less obvious stimulus consequences (e.g., building a tower, scribbling) also cluster together. Therefore, the nature of the target behavior may be a factor in the infant's tendency to imitate one behavior versus another. Uzgiris (1972) reached a similar conclusion based upon her observation that imitation of gestures preceded that of vocal behaviors.

Finally, some attempt was made in the Fels data to relate imitative behavior to other variables. No striking relations were found with parental education; but the presence of siblings, especially those 3-6 years older than the infant subject, were associated with differences in the propensity to imitate, although such effects interacted with sex.

Experiment 2: Imitation as a Function of Age, Sex, and Target Behavior

The Fels and Berkeley analyses provided an initial glimpse at "imitation-like" behavior. They strongly denied the presence of a pervasive trait of imitativeness, and they indicated that the likelihood an infant imitates a model may depend in part upon the stimulus products of the behavior to be imitated. However, it was not clear that the behavior displayed to these infant mental test items was indeed imitation. Therefore, our second descriptive examination of imitative behavior in infancy employed more rigorous operational definitions of imitation to ascertain whether the human infant indeed imitates modeled behaviors.

Another focus was on the development of imitative behaviors--do infants improve their ability to imitate with development? Most research

on imitation has pertained to much older children who are quite capable of perfectly imitating most modeled behaviors. As a result, the development of imitative behavior per se has rarely been considered. In contrast, Kaye (Note 6), Piaget (1951), and Uzgiris (1972) suggest that infants do not reproduce observed behaviors completely or with consummate accuracy at young ages, and that there is a pattern to the infant's developing ability to reproduce a modeled behavior. We intended to describe such development as it occurred in the second year of life, using an elaborate scoring scheme for grading the infant's response.

Finally, we could not ignore the message of the Fels and Berkeley data as well as reports of others (e.g., Uzgiris, 1972) which indicated that the nature of the modeled behavior is an important determinant of the likelihood of imitation in infant subjects. Therefore, seven categories of behaviors exemplified by three specific items were devised to assess potential differences in the likelihood of imitation.

Method

Subjects

Subjects were recruited primarily by sending a letter and a reply postcard to parents whose names appeared in newspaper birth announcements and county birth records. This mode of recruitment typically netted a 10-15% rate of reply. In addition, newspaper advertisements, the recommendations of former subjects, and families who had previously participated in studies of visual attention in the early months of life

in our laboratory were also used.

A usable sample of 100 infants approximately evenly distributed across sex and the ages of 12, 15, 18, and 24 months composed the sample. Of the total, 64% were tested within one week of the designated age and 95% were tested within two weeks. Half the subjects had no siblings at the time of their visit. Parents averaged 28.5 (mothers) and 31.6 years of age (fathers), with an average midparent education level on Hollingshead's (Note 8) scale (7 = highest) of 5.29, which represents approximately 1-2 years of college training. Most subjects had an excellent health history--only 6% of the mothers reported any complications during pregnancy and delivery and 2% said their infants had had a moderately severe health problem. No infant was seen if we suspected their contemporary behavior was under the strong influence of a detrimental health circumstance. On the average, subjects were seen 4½ hours after arising from their last nap and 1½ hours after their last feeding, although these figures varied directly with the age of the infant. Twenty-nine additional subjects were scheduled, of which 11 did not arrive for their appointment and 18 fretted or cried and were unable to complete the assessment. Parents were paid $3.00 to defray transportation expenses and given a Polaroid picture of their infant. These procedures and sample characteristics were typical of all the experiments reported in this monograph.

Procedure

Imitation items. Target behaviors for modeling were developed within seven general classes of behavior: motor behavior with an

object, motor behavior producing a form product, motor behavior producing a sound product, coordinated motor sequences, vocal behavior, social behavior, and incomparable feedback. The latter category included behaviors which the child could not monitor in the same modality when performing them as when observing another person perform them. Tongue protrusion is a prototypical example in which infants visually observe this act in another but cannot visually observe their own performance. The specific items are described in Table 6 and the objects are pictured in Figure 1.

Insert Table 6 and Figure 1 about here

Three specific items were devised within each class for a total of 21 items in the entire pool. Three test forms were created based upon the three combinations of pairs of three items within each class (e.g., Form A = items 1 and 2; B = items 1 and 3; C = items 2 and 3). Thus, a single subject was given two items from each of the seven classes, with the extra item in each class serving as an alternate when necessary (see below).

The behavior initially modeled for the subject was called the target behavior. It was this action which the subject was expected to imitate. However, for procedural reasons described below, each target behavior also was associated with a differential behavior consisting of essentially the same behavior as the target but with a slight modification (see below for a description of its purpose).

Table 6. Schedule of Imitation Items--Experiment 2

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
I. Motor with Object	1. Manipulation of semicircular block with facets on round side in order to prevent block from rocking spontaneously:		
	a) E depresses one end of the rocking block as far as possible, then releases it, causing it to rock back and forth several times.	a) S makes any attempt to manipulate block in upright position.	a) S depresses one end of block and succeeds in making two additional facets of the block come in contact with table.
	b) E holds one end of the block, still in the upright position, and keeps it level while pivoting a full 360° around the center point.	b) S makes any attempt to rotate block.	b) In upright position, pivots block at least 90°.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
I. Motor with Object	2. Motion with ring of spools: a) E grasps ring of spools with both hands, slowly raises them above her head and places over neck as necklace.	a) Raises spools vertically toward forehead; holds ring on head or to one side, or in back of head.	a) S places beads over head.
	b) E holds ring parallel to table, six inches from its surface, and moves ring laterally first 12" right, then 12" left.	b) Makes any predominantly lateral motion with spools.	b) S holds beads with both hands at least 3" above table, moves hands at least 6" first in one direction, then another.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
I. Motor with Object	3. Rectangular block moved in constant contact with table:		
	a) E moves block in long sliding motion from one edge of the table to the other edge 2 times.	a) S makes any elongated sliding motion in any direction with block.	a) S holds block and makes long sliding motion (greater than 3:1) with discrete, deliberate strokes; block in contact with table.
	b) E moves block in short, rapid strokes away from self and back 3 times.	b) S makes any abrupt motion with block.	b) S makes at least 2 consecutive forward and back, abrupt motions with block in constant contact with table.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
II. Motor with Form Product	1. Marking with crayon on pad so as not to produce sound with crayon:		
	a) E makes a clear horizontal stroke	a) S makes predominantly lateral stroke, but not necessarily a straight nor a single line (greater than 2:1).	a) S makes a discrete fairly straight line (greater than 3:1).
	b) E makes dots with up and down jabbing motion.	b) S brings crayon down hard on paper but then makes lines, or makes less than 3 dots.	b) S makes at least 3 dots with an up and down motion.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
II. Motor with Form Product	2. Small metal rings placed on Teddy bear:		
	a) Teddy bear is seated between S and E with the rings in front of the bear. E picks up one ring and places over the extended arm of the bear nearest her.	a) S picks up ring and tries to place on any part of the bear.	a) S places ring over either of bear's arms.
	b) E picks up ring and places over bear's ear nearest her.	b) S tries to place ring on any part of bear's head.	b) S places ring over either of bear's ears.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
II. Motor with Form Product	3. Wooden puzzle put together:		
	a) E puts the block together, forming the rectangle and thereby also completing 2 triangles.	a) S attempts to place the two sections of the block together in any fashion.	a) S forms the rectangle and consequent triangles such that no portion of one section is more than ½" from the target position.
	b) E places the two long sides of the sections together, consequently forming a geometric design resembling a face.	b) S attempts to place long sides together, but leaves them more than ½" from demonstrated pattern.	b) S places blocks together such that no portion is more than ½" from demonstrated pattern.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
III. Motor with Sound Product	1. Sound made with metal-tipped cord strung through can:		
	a) E picks up metal end of cord and strikes on bottom of can three times.	a) S manipulates metal-tipped cord, striking metal portion on any surface other than bottom of can.	a) S strikes metal tip on bottom of can at least twice.
	b) E picks up can by pulling cord up until can is 6" above table, then drops it onto the table.	b) S holds can off table by cord, or raps on table with can not held by cord.	b) S holds cord, lifting can clear of the table, then drops it, making sound.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
III. Motor with Sound Product	2. Striking of small cans to make sound:		
	a) E holds a can in each hand and strikes them together three times.	a) S makes attempt to bring the two cans together, or holds can in one hand, strikes other while still resting on table.	a) S holds can in each hand above table and strikes them together at least 2 times, making sound.
	b) E holds a can in each hand and raps them smartly on the table three times.	b) S strikes one can on table, or strikes both on table only one time.	b) S holds can in each hand and makes a sound by striking them on table at least 2 times.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
III. Motor with Sound Product	3. Sound made with wooden ring on end of cord and small box:		
	a) E holds end of cord swinging ring inside of box so that ring strikes each side of box in turn.	a) S holds ring by cord and hits box with ring in any fashion.	a) S swings wooden ring by holding cord, strikes inside of box at least two times.
	b) E turns over box, picks up ring in hand and strikes bottom of box three times.	b) S strikes box in any fashion while holding ring in hand.	b) S, holding ring in hand, strikes outside of box at least twice in succession with wooden ring.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
IV. Co-ordinated motor sequence with sound product	1. Brass cup with string attached used in conjunction with small metal rod: a) E picks up end of string holding cup off table 3 inches and strikes three times with rod. b) E holds rod in vertical position, resting on table, and swings cup so as to strike rod, three times.	a) S hits cup with metal rod but cup is resting on table; or holds cup in air and attempts to strike it with rod but misses. b) S hits rod by manipulating cup in any fashion.	a) S strikes brass cup with metal rod while holding cup clear of the table, using attached string. b) S uses string to swing cup, while holding rod; the two meet, making sound.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
IV. Co-ordinated motor sequence with sound product	2. Small cube used in conjunction with 2 nesting plastic cups:		
	a) E places cube in larger of plastic cups, covers it with smaller cup, picks up combination and rattles it by shaking cups from side to side.	a) S's combination of cups is incorrect and attempt to make noise is unsuccessful though S shakes.	a) S puts combination of cups together as modeled, shakes and succeeds in making a sound.
	b) E places small cup inside larger one, cube inside small cup and raps the combination on table three times.	b) Same as above.	b) S makes proper combination of cups and makes sound by rapping it on table.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
IV. Co-ordinated motor sequence with sound product	3. Two metal rings used in conjunction with flat circular block bisected by wooden dowel (a spindle):		
	a) E places rings over dowel and picking up circular block by using peg, raps block smartly on the table 3 times.	a) S puts ring over either peg, then raps spindle on table in any fashion.	a) S places rings over either peg and, holding that peg, bangs circular block on table.
	b) E holds circular block parallel to table, the dowel in a vertical position with the end resting on the table, puts the rings over the upper dowel and, holding the circular block, raps the bottom dowel smartly on the table three times.	b) S puts ring on peg, and hits spindle on table.	b) S holding circular block clear of table, puts rings over either peg while rapping other peg on table top at least 2 times.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
V. Vocal	1. Vocalizing motor sounds with aid of small car: a) E pushes small car with long strokes on table, accompanying the movement with "zoom." b) E pushes car with jerking movements on the table, accompanying the movement with "putt, putt, putt."	a) S makes any vocalization after modeling by E--not said before modeling. b) Same as above.	a) S vocalizes at least vowel and either consonant sound, may or may not manipulate car. b) S vocalizes approximation of modeled sound, must include vowel or initial consonant (p or b), or final consonant (t or d).

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
V. Vocal	2. Vocalizing of "all gone" and "bunny":		
	a) E places rabbit on table, covers with wooden box, says "all gone."	a) S makes two-syllable vocalization after modeling by E--not said before modeling.	a) S makes two-syllable vocalization after modeling, containing the appropriate vowel sound in each syllable (does not need to manipulate materials).
	b) Rabbit hidden, E removes box and says "bunny!"	b) Same as above--one syllable vocalization.	b) Same as above.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
V. Vocal	3. Telephone used to facilitate vocalization: a) E holds receiver of telephone to ear and says, "Hi, daddy."	a) S makes vocalization containing at least two syllables following modeling, not made before modeling.	a) S makes vocalization including vowel sound in "Hi," followed by at least one d sound and one vowel appropriate to "Daddy," (does not need to manipulate materials).
	b) E holds receiver, says "bye-bye" and hangs up the phone.	b) Same as above.	b) S makes two-syllable vocalization after modeling, containing appropriate vowel sound, or uses at least one syllable beginning with b-sound.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
VI. Social	1. Peek-a-boo played using screen:		
	a) E picks up screen and holding it about a foot off table peeks under it at S, 2 times.	a) S vocalizes "Peek-a-boo" and does not lift screen, or holds screen so face is not covered.	a) S lifts screen and peeks under it.
	b) E places screen in front of self, peeks around side, 2 times.	b) Same as above.	b) S peeks around side at least twice in succession.
	2. Soft foam ring used in social interaction.		
	a) E gently strokes S's hand and lower arm 3 times with side of ring, leaves her arm lying on the table.	a) S reaches forward with the ring, but does not touch E with it.	a) S touches E with ring, makes stroking motion.
	b) E slips the ring over S's arm like a bracelet.	b) S reaches toward E with ring or vocalizes intention to place on E.	b) S touches E's hand with ring in attempt to put it on her arm.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
VI. Social	3. Teeter-totter used for reciprocal play:		
	a) E depresses end of teeter-totter nearest her and says, "Your end goes up, my end goes down.	a) S pushes own end of teeter-totter up and down or depresses his end in response to E's actions only once.	a) S depresses own end of teeter-totter at least twice. (Consecutive reciprocal actions)
	b) E pushes apparatus closer to S saying, "I'll give you the teeter-totter."	b) S pushes apparatus back to E only one time, or vocalizes about giving it back to E but doesn't do it.	b) S pushes apparatus back toward E at least twice in response to her giving it to him.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
VII. Incomparable Feedback	1. Hand movements made with small sponge outside the field of vision:		
	a) E places sponge on top of own head, leaves for 5 seconds.	a) S makes motion with sponge toward top of head.	a) S touches top of head with sponge, releasing sponge. It does not have to remain there.
	b) E pats back of own head with sponge, 3 times.	b) S makes motion toward back of head, or makes patting motions with sponge.	b) S pats back of head with sponge at least two times.
	2. Motions made with head:		
	a) E shakes head vigorously from side to side, 3 times.	a) S moves head, but not in distinct back and forth motion.	a) S makes discrete back and forth movements of head.
	b) E nods head vigorously up and down, 3 times.	b) S moves head, but not in distinct up and down motion.	b) S makes discrete up and down movements of head.

Table 6. Schedule of Imitation Items--Experiment 2 (continued)

Category	Description of Target (a) and Differential (b) Behaviors	Approximate Imitation	Perfect Imitation
VII. Incomparable feedback	3. Touching ear, top of head: a) E puts hand on ear, saying, "I'm touching my ear."	a) S puts hand toward any part of head.	a) S places finger or hand on side of head, either on ear or close to it; hand must be outside S's field of vision.
	b) As above, touching top of head.	b) S puts hand toward any part of head except ear.	b) S places finger or hand on head above ear level, hand must be outside S's field of vision.

Figure 1

Table 6 presents detailed descriptions of the target behavior (labeled a) and the differential behavior (labeled b) for the three items within each behavioral category. In addition, the criteria for an infant's behavior to be scored as an "approximate imitation" and as a "perfect imitation" are given.

Procedure. The general nature of the observations were described to the parent on the telephone and an appointment to come to the Institute arranged. Upon arrival, the experimenter greeted the mother and child, led them to a carpeted experimental room, the episode was again described to the parent, written informed consent obtained, and the assessment began. At no time prior to the session was the word "imitation" used by staff personnel as a protection against the possibility that parents would coach their children in some way before or during the session. Parents were simply told that an adult would play with toys in front of the child and observe what the child subsequently did with those same objects.

The details of the procedure are presented in Table 7. The adaptation phase began as soon as the parent was seated with S on their lap in the experimental room. This period of time served three purposes. First, it permitted the infant to become adjusted to the E while E directed her attention away from the infant and to the parent. Second, toys were available which helped to establish a set toward

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Insert Table 7 about here

Table 7. Procedural Details of Experiment 2 (P = Parent, S = Subject, E = Experimenter)

I. Adaptation

A. When parent and child arrive at the Institute they are taken by the examiner to the carpeted experimental room. P is seated with child on lap. Two toys are in plain view on the floor (Slinky and Xylophone, toys not used in later imitation assessment), and the child is allowed to get down and play with them at will (by verbally requesting to do so or by sliding off P's lap to the floor).

B. E explains the nature of the observations, and obtains P's signature on the consent form. Biographical and socioeconomic information is obtained after the imitation session. P is asked to remain passive during the imitation session, not to take toys from S or to pick them up if they should be thrown on floor.

C. After 5 min., if S has not attempted to play with the toys, P and E encourage it, verbally at first, and then by putting S down on the floor.

D. Once S contacts the toys, S is given at least 5 min to play with them before being placed in a high chair at a table across from E. (P remains seated in back and to the right of S, three feet away.) Adaptation time varies from a minimum of 5 to a maximum of 30 min and is terminated when S freely exchanges toys with E and is willing to leave P to explore toys and room. Then S is placed in chair by P. If S objects, a third toy is presented in chair, otherwise the first imitation item is presented.

Table 7 (continued)

II. Individual Imitation Items

A. Spontaneous Play

1. S is presented item materials and allowed to play with them. (90 secs of appropriate social interaction with E was substituted for items not using special materials.) S and E have identical sets of materials for each item except where indicated in Table 6.

2. S is allowed to play until one trial lasts less than 5 sec. A trial consists of S contacting the toy and then not contacting it for 5 continuous seconds by ceasing active exploration of toy, verbally stating such, or throwing toy on the floor.

3. If S displays a perfect imitation (Table 6) of the target behavior, the alternate item from the same category is presented.

B. Original Target Behavior

1. E models original target behavior twice with a 2-sec pause between modeling. E stops if S is not attending, and resumes when S attends again. A verbal description of the behavior is given, but E avoids directives such as "look at this" or "can you do this?"

2. After modeling, E pauses to permit S to play with materials. If S does not contact materials within 5 secs. or contacts them for less than 5 secs, E presents materials once (i.e., picks them up and places them in front of S) and says S's name and "these are yours." If S contacts materials for more than 5 secs., E proceeds to the next step (#3 below)

Table 7 (continued)

after 15 secs or after a 5-sec no-contact period, whichever comes first. S is permitted to take E's set of materials if S wants them; however, S should only have one set available at any time.

3. After the criterion in #2 above is reached, E remodels the target behavior once, stopping if S does not pay attention.
4. E pauses for S to imitate as in #2 above for a maximum of 15 secs.
5. E remodels as in #3 above.
6. E pauses for S to imitate as in #2 above, except E allows a maximum of 90 secs of manipulation.
7. This entire sequence is terminated if and when S displays an unequivocally perfect imitation of the target behavior (see Table 6), whence E proceeds immediately to model differential target behavior (i.e., C, below). If it is unclear whether imitation was perfect by the end of step #6 above, E then proceeds to C. If S's behavior does not meet the criterion for perfect imitation (Table 6), E proceeds to the next item.

C. Differential Target Behavior

1. E models differential target behavior (see Table 6) only for those Ss who have displayed perfect imitation of the target with the procedure described in B1 to B6 above.
2. If S does not display at least an approximate imitation of the differential target behavior by the end of this sequence, E proceeds to the next item.

Table 7 (continued)

D. Re-Presentation of Original Target Behavior

1. If S was given the differential target, E remodels the original target behavior with the same procedure (i.e., B1 to B6 above).

E. Deferred Imitation

1. After all items are completed, E presents in the same sequence the materials for the first seven items, one from each category except Incomparable Feedback and Social. E does not remodel the original or differential targets. One presentation of the materials is given. A trial consists of S contacting the toy and then discarding it for 5 continuous secs, verbally stating such, or throwing the toy on the floor.

III. Play

After the imitation session, P is seated in the playroom, holding S on his/her lap. On a signal from E, P puts S down on the floor and encourages nonspecific play with the toys. Further encouragement is given if necessary. The toys include those used in the imitation session (with the exception of incomparable feedback and social items), plus two novel objects (a wooden wagon and a small, flexible mirror).

In the observation room, a beep occurs every 5 seconds, at which time one observer records the code letter for the toy or toys S was playing with during the previous 5-sec interval as well as S's position in the room at that time. The distance is coded by indicating

Table 7 (continued)

which of 9 squares marked on the floor with tape the S occupied. The second observer records on tape as complete a behavioral record as possible.

The play session is terminated when S goes to P asking to be held and shows no interest in returning to the toys for 30 seconds in a single incident, or when 15 minutes has elapsed, whichever occurs first.

playing with objects in this context. Third, most veterans of infant mental testing know that the social apprehension of a child toward the examination situation can influence performance. Therefore, several variables were recorded during adaptation to measure each S's general social apprehension in this context. The variables included the latency to touch the first toy, the total time in physical contact with the parent, and the total time in the adaptation phase.

When the adaptation criterion was reached (see Table 7), the 14 individual imitation items were presented. Each item presentation began with spontaneous play, a period in which the infant could play freely with the materials to be used for that item. If the S displayed the target behavior perfectly during this spontaneous period, that particular item was discarded and the alternate item in that category used. This was a major methodological advance over previous studies of imitation which had not controlled for the possibility that the infant might spontaneously display the target behavior without ever seeing that behavior modeled.

Once the criterion for the spontaneous play period had been achieved (see Table 7), the original target behavior was modeled twice in succession followed by a pause during which S could play with (presumably imitate) the test materials. The target was modeled twice more if necessary.

For those subjects who displayed a perfect imitation of the original target, a differential target behavior was modeled. The differential target is described for each item in Table 6 (listed under b). This pro-

cedure was instituted to test whether the infant actually imitated what the examiner had done, or whether the modeling merely facilitated in some nonspecific way the infant's behavior with the objects which might include the target behavior. For example, it was possible that the infant actually did not imitate the model but merely became generally more interested in the materials after seeing the modeling, and such an increase in involvement might lead to the spontaneous display of the target behavior after rather than before modeling. However, if an infant displayed perfect imitation of the original target and of the differential target, one could be secure in the conclusion that the infant had indeed imitated the details of the modeled behavior. As a further check on this point, if the infant imitated the differential target, the original target behavior was re-presented to determine if the infant would again imitate the original target after performing the differential.

The last phase of the assessment regimen was a free play session in which the test materials plus two novel objects were placed on the floor and the infant allowed to play at will. The number of perfect imitations displayed during the play session (see Table 6 for definitions) was recorded.

Scoring of imitation. A major purpose of this study was to describe with an objective scoring scheme the nature of the imitative behavior for the purpose of observing developmental changes in the infant's accuracy of producing the various targets. The work of Uzgiris (1972) and Kaye (Note 6) indicated that very young infants might(a) not play

with the toys at all, (b) play with the objects but not pattern their behavior after the modeled actions whatsoever, (c) repetitively perform some action dissimilar to the target after each modeling (a "you do something and I'll do something" game), and (d) copy the original behavior with progressively greater accuracy. These observations were formalized into a scale of imitation which is presented in Table 8. The

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Insert Table 8 about here

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score value served both as a nominal category as well as a single number reflecting the level of imitation observed (henceforth called the scale score).

Independent variables. The two major independent variables were the age of the subjects (12, 15, 18, and 24 months) and the seven categories of behaviors which were modeled (i.e., motor with object, motor with form product, motor with sound product, coordinated motor sequence, vocalization, social, and incomparable feedback). Sex of subject was also evaluated (but the E was always a female).

There were several procedural variables which were included as independent factors to broaden the generality of the results. First, there were three different test forms each containing two of the three items in each behavioral category. Within a test form, one item from each category was presented as the first seven items followed by the remaining seven items. A single item served on two of the three test forms once in combination with each of the other two items. The item not included on a specific test form served as an alternate and was

Table 8. Scoring of Imitation Behavior

A. Original Target Behavior

Score	S's Behavior
1	S refuses to manipulate materials.
2	S manipulates materials, but does not perform the same pattern of manipulation on two or more trials. S's manipulation does not approximate target.
3	S performs the same pattern of manipulation of the materials on two or more trials but that behavior is not an approximation of the target.
4	S performs an approximation to the target (defined in Table 6) on at least one trial but there is no evidence of progressive improvement over trials in the accuracy of S's approximation of the target.
5	Same as 4 above but with some sequential improvement in the accuracy of S's approximation of the target. S never reproduces target behavior perfectly.
6	Same as 5 above but S ultimately reproduces target perfectly (defined in Table 6).
7	S displays a perfect reproduction of the target on the first attempt to manipulate the materials.

B. Differential Target Behavior

8	S approximates differential target (defined in Table 6).
9	S successfully reproduces differential target perfectly (defined in Table 6).

Table 8 (continued)

C. Re-Presentation of Original Target Behavior

10 S successfully imitates the original target

D. Deferred Imitation

11 S approximately imitates one of the target behaviors (original or differential) on the deferred test.

12 S performs 11 above, but with perfect imitation.

administered in the event of a spontaneous display of the target behavior prior to modeling. In no case were both items of a category spontaneously displayed.

Second, the items on each of the three test forms were presented in one of two different orders. Thus, there was a total of six different item presentations, three test forms each executed in two different orders.

Experimenter was also varied, although not as systematically as we had intended. All three E's were female and the number of subjects seen by each E were not equal (Ns = 26, 30, and 44).

Finally, the toys were placed in two different arrangements during the play session to approximately equate the relative distance of the toys on the floor from the location of the subject's mother.

Results

Preliminary Analyses

Reliability. Extensive pilot testing preceded the execution of this experiment, and coders had ample training in scoring imitative behavior. Formal reliability assessments between two coders were made on 13 subjects, each of whom received the full complement of 14 imitation items.

The most detailed description of the imitative behavior involves the subject's response to the original target which was the 7-level scale score (Table 8). Correlations between observers were calculated across 14 items separately for each of the 13 reliability subjects. These correlations ranged between .80 and 1.00 with a median across the 13 subjects of .99. Another dependent variable of interest was simply the likelihood

of a perfect imitation (e.g., a score of either 6 or 7 on the scale score presented in Table 8). On 62 of 64 instances (97%) one coder recorded an imitation, the other coder agreed. The reliability of an approximate imitation (i.e., 4 or 5 on the scale score in Table 8) was less impressive -- 13 of 18 (72%) of occasions when an item was scored as a 4 or a 5 by one coder, it was scored as a 4 or a 5 by the other coder. However, approximate behaviors were infrequent and not important to the characterization of most of the behavior to be reported.

In the deferred situation, a judgment of no imitation/imitation (approximate or perfect) was required, and there was 92% agreement between the two coders.

The timing measures had individual subject reliabilities between .85 and .99 with a median of .97.

Spontaneous displays of target behaviors. The observations were designed such that each infant was permitted a period of time in which the target behavior could be spontaneously displayed before the modeling sequence began. This represented a within-subjects control for spontaneous versus imitative behavior. Spontaneous displays of target behaviors occurred infrequently--only 3.6% of the 1400 item presentations in the entire study. Spontaneous displays of the target increased with age. The percentages for the 12-, 15-, 18-, and 24-month groups, respectively were 1.6%, 3.2%, 4.0%, and 5.3%. This trend probably derives from the fact that the older subjects played with the objects more adroitly and were more capable of discovering interesting things to do with the toys than were younger subjects. As might be expected, spontaneous displays

were lowest among the incomparable feedback, social, and vocal items and highest for motor with object and motor with sound categories.

Adaptation phase correlates. One purpose of the adaptation phase was to adjust the infant to the experimental setting. An Age x Sex x Test Form analysis of variance was conducted on the three adaptation phase measures--the latency to touch the first toy, the total contact time with the parent, and the total time of the adaptation phase. The independent variable of test form was added as a check on cell assignments in this regard (the test forms had not yet been administered at this point in the assessment schedule). While there were no Age or Sex x Age effects for these three variables (p's between .41 and .87), girls spent more time in contact with their parents, $F(1,76) = 10.74$, $p < .002$, and took longer to touch a toy, $F(1, 76) = 11.27$, $p < .001$.

Of greater concern was the possibility that the propensity to imitate would be related to the child's social apprehension in the strange context of the experimental assessment. Therefore, correlations were calculated within each Sex x Age x Test Form cell and pooled across all cells to provide an estimate of the extent to which individual differences in adaptation apprehension correlated with imitative performance. The within-cell correlational approach is required, because there were mean differences on the adaptation and imitation variables associated with these independent variables, a circumstance that can produce correlations by itself. Thus, the within-cell correlational approach is somewhat akin to assessing the correlation between these dependent variables with the independent factors of sex, age, and test form partialed out.

The within-cells correlation for latency to touch a toy, amount of parental contact, and total adaptation time with subjects' scale score of imitation to the original target averaged over all 14 items ranged between -.06 and -.13, which values did not reach the required level of significance ($r_{.05}$ = .22). Further, the adaptation variables did not show any significant correlations with original target imitation scale score calculated separately for each of the seven item categories. Therefore, measures of the child's social apprehension in the strange context did not relate to subsequent imitation performance when assessed separately from sex, age, and test form differences. The adaptation variables will not be considered further.

Imitation of the Original Target Behavior

Age and item category. The major independent variables of interest were age and item category. These factors along with sex and test form were the independent variables in a four-factor analysis of variance on the original target imitation scale score (1-7 points) described in Table 8. No special precautions were taken in this repeated-measure analysis or ones subsequently reported in this monograph to guard against the potential bias associated with heterogeneity of covariance (see McCall & Appelbaum, 1973). In each case, the covariances were sufficiently comparable to make special corrections unnecessary.

There were no significant main or interaction effects for the sex factor (all F's < 1). The level of imitation increased with age, $F(3,76) = 20.33$, $p < .001$, and differed as a function of item category, $F(6,456) = 19.10$, $p < .001$. But these main effects were qualified by

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Insert Figure 2 about here

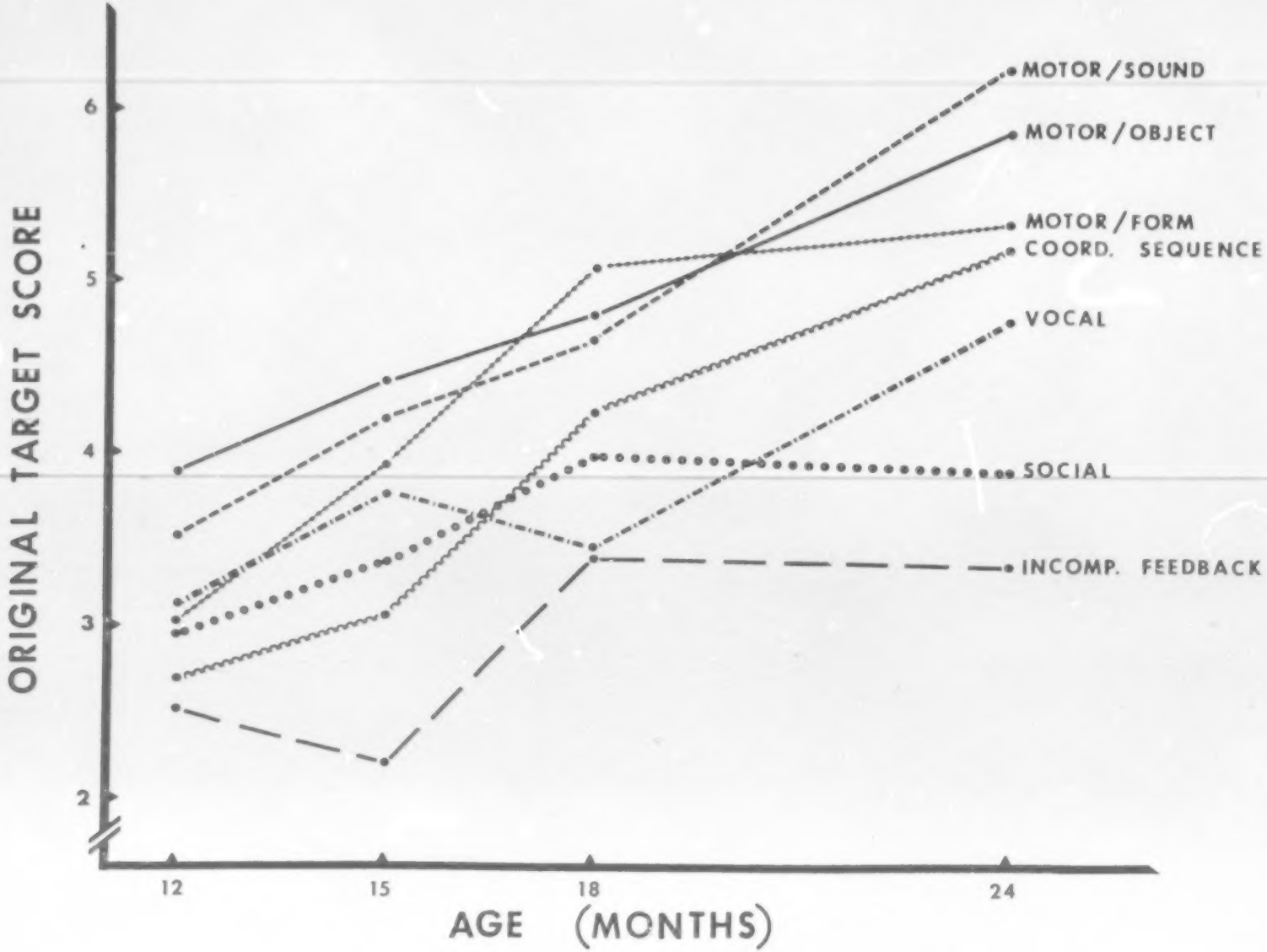

ORIGINAL TARGET SCORE
6
5
4
3
2
MOTOR / SOUND
MOTOR / OBJECT
MOTOR / FORM
COORD. SEQUENCE
VOCAL
SOCIAL
INCOMP. FEEDBACK
12
15
18
24
AGE (MONTHS)

Figure 2

an Age x Item Category interaction, $F(18,456) = 2.36$, $p < .005$, indicating that the age trend was not the same for all categories.

The mean original target scale score for each of the seven item categories is plotted as a function of age in Figure 2. There is a tendency for motor or gestural imitation (e.g., motor with object, motor with sound product, motor with form product) to be more frequent and/or more accurate than imitation involving a social element (e.g., vocal, social, incomparable feedback), although the distinction is less clear at the younger ages. Moreover, the imitation of coordinated sequences is less precise than the other motor categories at all ages. From a developmental standpoint, imitation of simple motor acts increases in approximately a linear fashion across age, imitation of social behavior shows a slower rise across age, and the imitation of coordinated sequences makes its largest jump between 15 and 18 months. Several a priori comparisons are described below using the error terms of the general analysis.

Form versus sound product. The analyses of the Fels and Berkeley data suggested there may be a major distinction between the imitation of behaviors that produce a sound as a stimulus consequence of their execution versus those that result in a form product. Three a priori comparisons were made in this regard. First, the Fels and Berkeley data showed this distinction to be clearest at approximately 1 year of age. Therefore, performance on sound-versus form-product items were compared only for the 12-month sample. The $F(1,456) = 1.53$ was not significant. A similar comparison was made over all ages with the same

result, $F(1,456) = 2.07$, and there was no difference in the developmental trend for these two item categories, $F(3,456) = 1.76$. Therefore, there were no mean or developmental trend differences for the sound-versus form-product items. However, the Fels and Berkeley result involved the clustering of individual differences and not necessarily the average level of performance. Analyses more directly comparable to these early findings appear below.

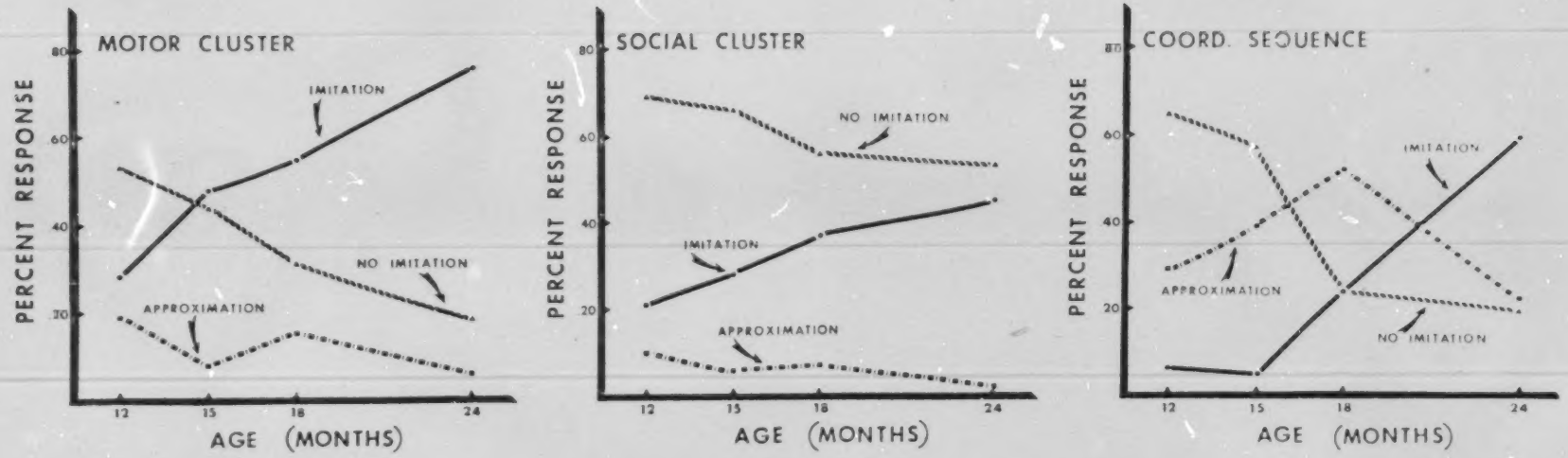
Vocal versus motor items. Uzgiris (1972) reported that infants in the first year of life imitated gestural behaviors earlier and more frequently than vocal behaviors. This proposition was tested by comparing the level of imitation on the vocal category separately with the motor with object, motor with form product, and motor with sound product categories. In each case, the level of imitation averaged across all four ages was higher for the motor categories than for the vocalization items: $F(1,456) = 15.08$, $p < .001$; $F(1,456) = 5.04$, $p < .025$; $F(1,456) = 13.59$, $p < .001$; respectively. Differences in developmental trends between vocal and motor behaviors were also assessed, but only one of the three comparisons was significant. The imitation of motor behaviors with form products increased sooner and steeper than did the developmental curve for vocalization items, $F(3,456) = 3.49$, $p < .025$. Therefore, vocal items are imitated less frequently or accurately than simple motor items and may show a later developmental spurt in some cases.

Coordinated sequences versus simple motor behavior. Because coordinated sequences involve attending to, encoding, associating, remembering, and retrieving two behavioral acts rather than one, imitating coordin-

sequences should be more difficult than imitating simple motor acts. Therefore, the response to the coordinated sequence category was separately compared with scores from motor with object, motor with form product, and motor with sound product. The level of imitation was greater for simple motor acts than for coordinated sequences averaged across all four ages for each of these three comparisons ($p < .001$) with $F(1,456)$ values of 19.28, 7.58, and 17.59, respectively. Differences in developmental trend between coordinated sequences and the three types of motor actions were also assessed, but there were no significant results (all Fs < 1). Therefore, regardless of their perceptual consequences, simple motor behaviors are imitated more readily than are coordinated sequences of two or more such behaviors.

The Development of Imitation

Figure 2 indicates that the level of imitation increased between 12 and 24 months, although the precise pattern and the level of performance differs as a function of the type of behavior being modeled. However, these graphs are for the imitation scale score and have limited value in conveying the development of the qualitative form of the imitation behavior. For example, when the dependent variable is the percentage of items perfectly imitated (a score of 6 or 7 on the scale presented in Table 8), a more interesting picture emerges. Specifically, the three simple motor categories (motor with sound, motor with object, motor with form product) show relatively similar developmental patterns, and we will call these items the motor cluster. Also, the developmental patterns of the vocal, social, and incomparable feedback categor-


MOTOR CLUSTER
PERCENT RESPONSE
80
60
40
20
IMITATION
NO IMITATION
APPROXIMATION
12
15
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24
AGE (MONTHS)
SOCIAL CLUSTER
PERCENT RESPONSE
80
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NO IMITATION
IMITATION
APPROXIMATION
12
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AGE (MONTHS)
COORD. SEQUENCE
PERCENT RESPONSE
80
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IMITATION
APPROXIMATION
NO IMITATION
12
15
18
24
AGE (MONTHS)

Figure 3.

ies were similar, a group of items we will label the social cluster (because most of these items involve direct social interaction with the examiner). Coordinated sequences followed a unique pattern. Therefore, to clarify the following presentation, data will be presented on the motor cluster, social cluster, and coordinated sequence category as a strategy of summarizing the seven original categories.

Insert Figure 3 about here

Percent perfect imitation. Imitation of these three clusters of items across age is depicted in Figure 3, but in contrast to Figure 2, the dependent variable now is the percentage of items in the cluster which were perfectly imitated (scale scores 6 or 7), approximated (scale scores 4 or 5), or not imitated (scale scores 1, 2, or 3). Concentrating on the motor and social clusters which included all items except coordinated sequences, one sees first that very little approximate imitation occurred. Infants either imitated the behavior perfectly, or they ignored the model's actions. Thus, for single unit motor or social behaviors, imitation was essentially all-or-none. This result seems to contradict Kaye (Note 6) and Uzgiris (1972) who claim that infants do display approximate imitations. However, both Kaye and Uzgiris worked with infants younger than 12 months of age, our youngest age group; therefore, one might hypothesize that the development of the nature of the imitative behavior per se for single unit actions is essentially complete by 12 months. This proposition nevertheless leaves unanswered the question of determining the circumstances under which the

infant will, in fact, imitate.

In contrast to the motor and social clusters, the data for coordinated sequences followed a notably different pattern. First, perfect imitations of motor and social behaviors showed essentially linear increases over age, progressing from 28% to 76% for motor and 21% to 45% for social behaviors. In contrast, there was only 5-6% perfect imitation of a coordinated sequence at 12 and 15 months of age, 24% at 18 months (a figure roughly comparable to the 12-month percentage for single unit behaviors), and 59% at 24 months. Therefore, essentially no perfect imitation of coordinated sequences appears until approximately 18 months and no substantial percentage until approximately two years of age. Since each of the two components of a coordinated sequence was comparable to the single unit behaviors included in the motor clusters, one might hypothesize that some transition in cognitive ability transpires between 15 and 24 months of age which permits infants to deal with a coordinated sequence of acts (see below).

Approximate imitation. A second difference between the motor and social clusters on the one hand and coordinated sequences on the other is the role of approximate imitations. First, whereas there are essentially no approximate imitations of a single unit behavior (the percentage was always less than 19% with an average of 11%), the percentage of approximations to a coordinated sequence ranged between 22% and 52%, peaking at 18 months. Second, notice that at 12 and 15 months, 30% to 40% of the infants approximated a coordinated sequence but only 5-6% imitated it perfectly, whereas at 18 months half the infants ap-

proximated the target while a quarter imitated it perfectly. Therefore, approximations to coordinated sequences peaked at the time when 24% of the infants could imitate the sequence perfectly, suggesting that approximations occurred when infants were approaching the age of ability to perform the sequence. Third, the difference between the developmental patterns for the coordinated sequence category and the social cluster demonstrates that these points regarding coordinated sequences are not simply a function of the level of performance, because the percentage of children imitating the social items was approximately the same as for coordinated sequences. Fourth, the contrast between the motor cluster and coordinated sequences suggests that the unique character of coordinated sequences does not reside in the motor behaviors per se. Therefore, we interpret the contrast in results to be associated with the linking of two behaviors which defines a coordinated sequence as opposed to factors associated with the mode of the actions per se or with specific levels of performance. Further, these results seem to reflect our observation that some children would begin but not complete the coordinated sequence, appearing to forget the second component of the sequence half way through the binary act. Thus, it was the linking of the two elements that seemed to be crucial in imitating a coordinated sequence.

Discussion. We believe the unique pattern of results for coordinated sequences implicates a major cognitive transition transpiring between 15 and 24 months of age which permits infants to encode, store,

and retrieve an association between two observed entities and to use such an association to guide their own behavior. McCall, Eichorn, and Hogarty (1977) using mental test data from the Berkeley Growth Study have suggested that such "entity-entity" relationships first become possible after 13 months of age, a cognitive ability that permits an infant to draw an association between two entities in the environment without physically interacting with those objects. Moreover, McCall et al. (1977) also suggest that symbolic relationships are possible after 21 months, thus permitting the infant to symbolically associate two entities or their symbolic representatives. Since the imitation of coordinated sequences requires an association between two entities that is coded symbolically and retained over a short time (the latency between observing the model and the infant's performance of the behavior), entity-entity relationships seem to be a prerequisite of imitating coordinated sequences and symbolic relations would help the infant retain the observed information long enough for it to be used to guide behavior.

Qualifications on Age and Item Category Results

The observations in this study were also designed to assess the effects of sex, test form, and specific examiners. Consequently, the results reported above were examined for possible interactions with these factors.

Sex. Both the original target scale score as well as the percentage of perfect imitations were analyzed with Age x Item Category x Sex x Test Form analyses of variance. There were no main effects or interactions for the sex factor (all F's < 1).

Test form. The only effect for test form was a significant Form x Item Category interaction for both the original target scale score, $F(12,456) = 4.41$, $p < .001$, and for the number of perfect imitations, $F(12,456) = 3.42$, $p < .001$. All other F's were less than 1. These results simply indicated that some specific items within each category were imitated more than others--that is, items were not totally equal in their power to provoke imitation within an item category. Because test forms differed in the specific items composing them, there were test form effects. However, the Test Form x Age x Item Category interaction was not significant ($F < 1$), thereby indicating that the developmental trends displayed in Figures 2 and 3 are not qualified by test form. Consequently, the major results described above for item category and age are not qualified to any important extent by test form and may be considered general across specific test forms.

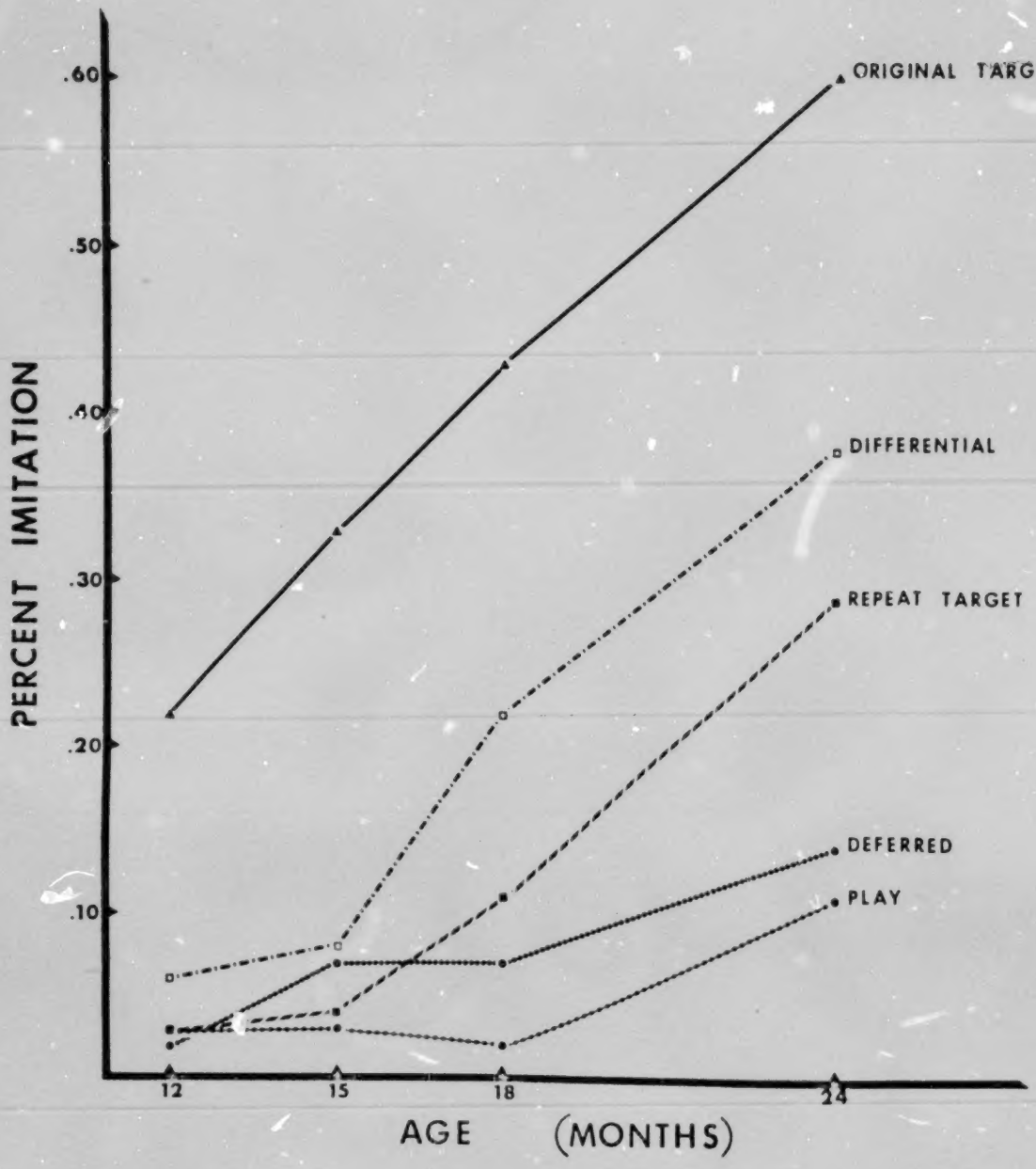
Examiner. A staff resignation made our assessment of a possible experimenter effect inelegant. Three experimenters were used in this study, but they saw different numbers of subjects--44, 30, 26. However, each experimenter saw at least four subjects at each age, permitting an Age x Item Category x Experimenter analysis of variance to assess any qualifications on the major results associated with particular experimenters. Such an analysis was carried out for both the

original target scale score as well as the number of perfect imitations per category.

There was a main effect for experimenter for both dependent variables--$F(2,88) = 4.74$, $p < .02$ and $F(2,88) = 3.74$, $p < .05$, respectively. One experimenter was simply more adroit at eliciting imitative behavior than were the other two. In addition, the more successful experimenter produced a steeper age trend over all item categories with respect to the original target scale score, $F(6,88) = 2.29$, $p < .05$, but not with respect to the percentage of perfect imitations, $F(6,88) = 1.76$. There were no other significant effects. Because the major results reported above were for the Age x Item Category interaction and because this two-way interaction was not qualified by a further interaction with experimenter ($F < 1$, $F(36, 528) = 1.21$, respectively for the two dependent variables) the primary results of this study are not qualified by the particular examiner and may be generalized across experimenter.

Differential, Re-Presentation of Target, Deferred, and Play Phases

General comparisons across phases. Sex x Age x Item Category x Test Form analyses of variance were performed separately on the percentage of perfect imitations of the differential target, the re-presentation of the original target, the original target or the differential during the deferred imitation phase, and the original target or the differential during play. These analyses were identical in their conclusions--highly significant main effects for Age and Item Category as well as for the Age x Item Category Interaction were observed, while


.60
.50
.40
.30
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.10
PERCENT IMITATION
ORIGINAL TARGET
DIFFERENTIAL
REPEAT TARGET
DEFERRED
PLAY
12
15
18
24
AGE (MONTHS)

Figure 4

there were no effects for the other variables.

A summary of developmental changes in the percentage of perfect imitation in all phases of the assessment procedure is presented in Figure 4. The important part of this graph is a comparison of develop-

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Insert Figure 4 about here

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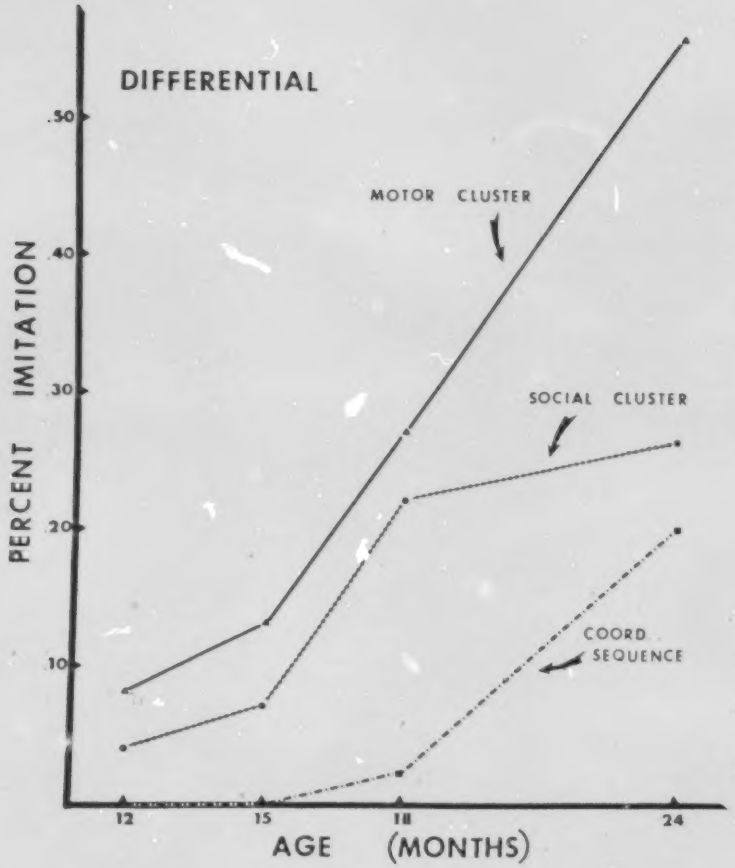
mental profiles--the differences in general level of these curves is not very meaningful because of procedural and statistical dependencies in these data (which also prevent direct statistical comparisons across test phases). What can be seen, however, is that while the probability of a perfect imitation during the original target phase of the assessment increases almost linearly between 12 and 24 months, substantial improvement in the probability of imitation during the other phases does not occur until 18 or 24 months. Specifically, executing the differential target perfectly does not occur with any reasonable frequency until 18 months of age. Imitating the original target behavior after the differential is presented shows some improvement at 18 months but nearly triples in frequency by 24 months. The two types of deferred imitation (e.g., in the "deferred" phase and in the play session) do not show substantial developmental increases until 24 months.

Discussion. These data imply that simple imitation increases linearly between 12 and 24 months from a probability of .22 to .60. In contrast, when a child who approximates or imitates the original target is then presented with a model that performs a slightly different version of the original target behavior, nontrivial levels of

imitative performance of this differential behavior do not occur until 18 months. This could be interpreted to imply that children are not really imitating the original target behavior because they do not change their imitative response with a small change in the modeled behavior. This was the original intention of including the differential phase in the assessment program. However, after watching the subjects, we do not subscribe to this interpretation. Rather, we believe the children did notice the difference between the original target and the differential and evidenced this cognition by displays of curiosity, attention, and verbal comment. Some seemed confused by the slight change, and some subjects behaved as if the experimenter had made a mistake by modeling a different behavior from the original target. Therefore, we believe the subjects did notice the difference between the original target and the differential and were imitating the specific aspects of the model's behavior during the original target phase despite the fact that they did not follow through by imitating the differential behavior until 18 months. The fact that the likelihood of imitating the re-presentation of the original target followed the same developmental path as the imitation of the differential is viewed as a product of the confusion subjects apparently experienced in the face of a model who went back and forth between one behavior and another.

After the entire set of items had been presented, subjects were given the stimulus materials without additional modeling both in the


DIFFERENTIAL
PERCENT IMITATION
.50
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MOTOR CLUSTER
SOCIAL CLUSTER
COORD SEQUENCE
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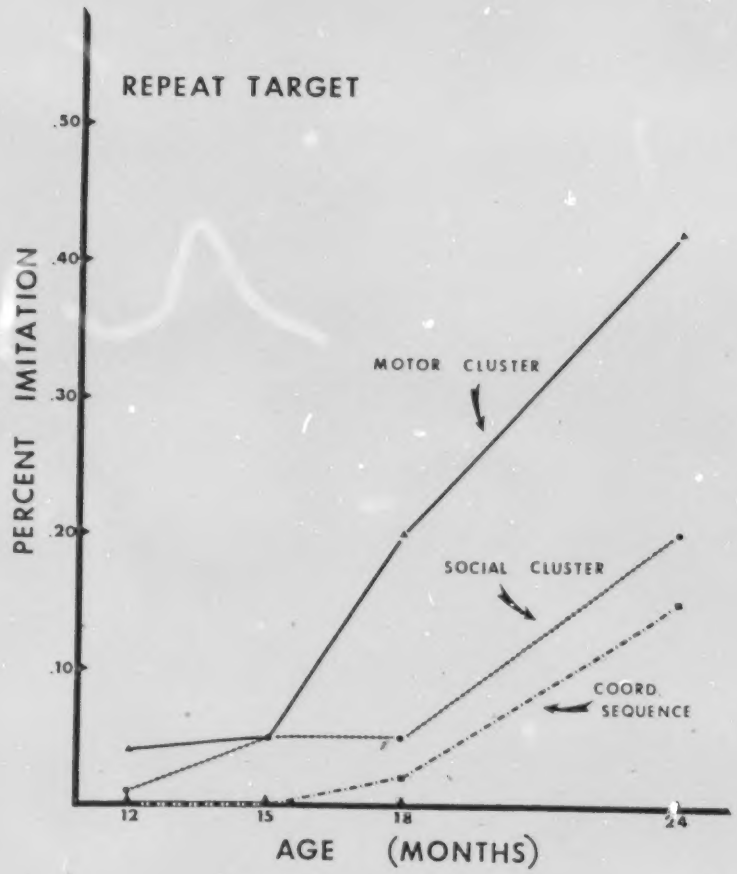
AGE (MONTHS)


REPEAT TARGET
PERCENT IMITATION
.50
.40
.30
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.10
MOTOR CLUSTER
SOCIAL CLUSTER
COORD SEQUENCE
12
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18
24
AGE (MONTHS)

Figure 5

same context as the original item assessments or in a free play session conducted in another room. The likelihood of an imitation occurring under these deferred circumstances was not great at any age, but the percentage sharply increased at 24 months. Piaget (1951) has suggested that the display of deferred imitation signifies the presence of the symbolic function, because such behavior requires the child to retain symbolically an action and relationships between entities that are subsequently retrieved and used to guide behavior. The symbolic function of Piaget as well as that described by McCall et al. (1977) is said to occur between 18 and 24 months (varying with task requirements), precisely the time that the frequency of deferred imitations rose in the present observations.

Item type. The general analyses indicated that the developmental trends for the likelihood of a perfect imitation were different as a function of item type. Again, the data could be described most efficiently by grouping the three motor categories (motor/object, motor/form, and motor/sound) into a "motor cluster," grouping the social, vocal, and incomparable feedback items into a "social cluster," and treating coordinated sequences as a category in itself.

The developmental profiles for these three item clusters are presented at the left of Figure 5 for the differential phase and at the

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Insert Figure 5 about here

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right for the re-presentation of the target. Readers should recall that

these two phases were presented only if the infant evidenced an approximate or a perfect imitation during the original target phase, although the percentages use the entire sample as a base (which makes the assumption that those subjects that did not imitate the original target would not imitate the differential or the re-presentation of the original target). The difference between the three clusters is the same in each of these two phases. Performance is highest and consistently increases across age for the single-unit motor items. The profiles for the social cluster follow the same general developmental trend as for the simple motor items, but the level of performance is lower. In contrast, a perfect imitation of a coordinated sequence essentially never occurs in these phases until 24 months of age.

We believe the major difference between coordinated sequences and the other item types resides in the requirement of the infant to symbolically associate two entities and retain that memory long enough to guide subsequent behavior. Therefore, some symbolic capability is needed to imitate a coordinated sequence; and the longer between the observation of the model and the performance of that behavior, the more such a symbolic system is required. Moreover, the differential and re-presentation phases put additional information into the system, and one might expect that the symbolic requirements must be even more advanced to permit an imitation of a coordinated sequence in these phases than in the original target phase. Such appears to be the case.

Deferred phases. Similar data for the deferred session are presented in Figure 6. The graph at the left of Figure 6 presents

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Insert Figure 6 about here

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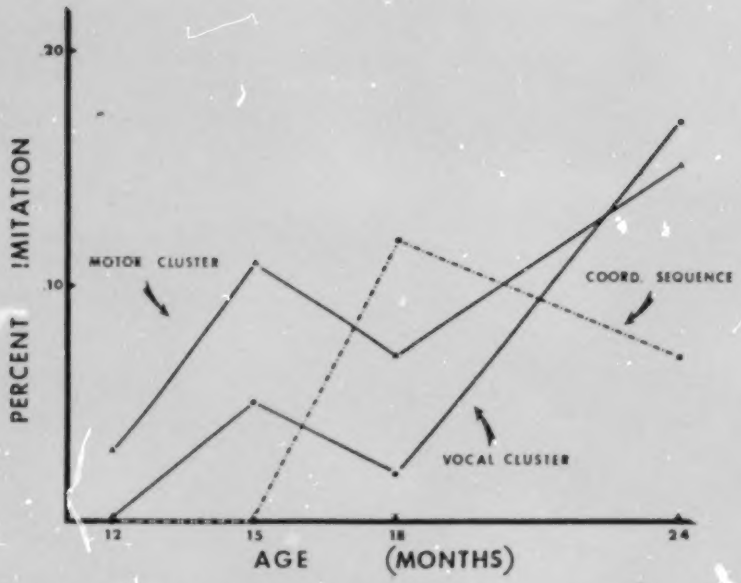
the percentage of perfect imitations for the motor cluster, vocal behaviors, and coordinated sequences. This is the same type of information that is presented in Figure 5 above, except that incomparable feedback and social items which did not require materials were not considered in the deferred phase. By this point in the assessment schedule, infants who had imitated a specific item in the original target phase had the additional inputs of the experimenter modeling the differential and then the re-presentation of the target plus the modeling of other items and the passage of time--all of which presumably increase the load on the symbolic system to encode, associate, remember, and retrieve observed information. Consequently, it is not surprising that major increases in performance and nontrivial levels of imitation of the motor and vocal behaviors did not occur until 24 months of age. No coordinated sequence was imitated at all at 12 and 15 months, and only modest frequencies were displayed at 18 and 24 months. We believe the developmental spurt for coordinated sequences which was observed for the differential phase at 24 months has not yet occurred for the deferred circumstance.

At the right of Figure 6 is the graph of the percent of approximate imitations for these three item clusters as a function of age.


PERCENT IMITATION
20
10
MOTOR CLUSTER
COORD. SEQUENCE
VOCAL CLUSTER
12
15
18
24
AGE (MONTHS)

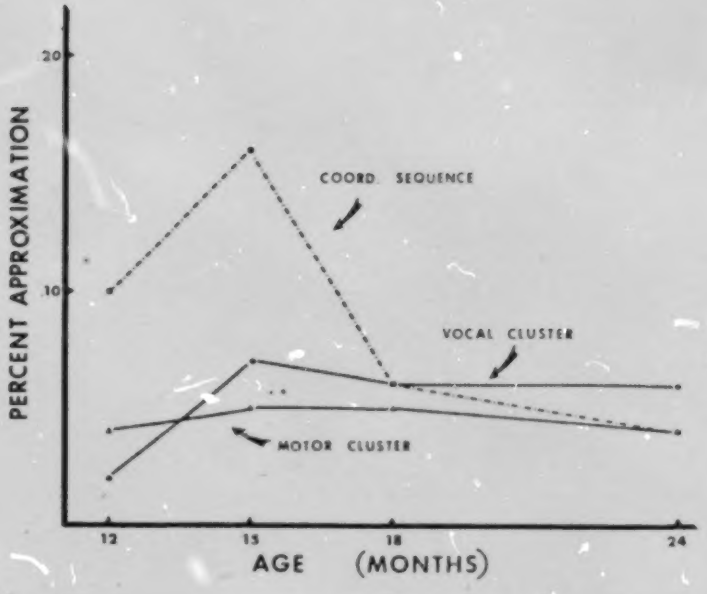

PERCENT APPROXIMATION
20
10
COORD. SEQUENCE
VOCAL CLUSTER
MOTOR CLUSTER
12
15
18
24
AGE (MONTHS)

Figure 6

This graph provides additional evidence that the crucial element in imitating coordinated sequences is the cognitive ability to associate two observed events, an ability that presumably does not occur until 18-24 months. The graph of approximate imitations indicates a much higher level of approximate behaviors for coordinated sequences at 12 and 15 months during the deferred phase than for the other item types. Glancing to the left of Figure 6, these are the ages at which no perfect imitations of a coordinated sequence occurred. Moreover, if approximations and perfect imitations are added together for motor versus coordinated sequences. the percent of approximate-plus-perfect imitations is nearly the same for these two classes across age: motor--7%, 16%, 12%, 19%; coordinated sequences--10%, 16%, 18%, 11%. Therefore, we believe the association between the two elements of a coordinated sequence is the crucial cognitive ability required to perfectly imitate a coordinated sequence, and such performance does not occur with substantial frequency in the population until approximately 18-24 months of age. Moreover, the greater the information load and memory demands of the task, the more mature the symbolic system must be for imitation to occur.

Results similar to those for the deferred phase occurred during the play session and support these interpretations. No coordinated sequence was perfectly imitated during play at 12 months and only one 15-month and one 18-month infant imitated a coordinated sequence in

play. In contrast, 8 such imitations occurred at 24 months. However, imitations of any behaviors were extremely rare until 24 months--the percentage of all items imitated during play prior to two years of age was approximately 3%, but it was 11% at 24 months. The percentage of subjects providing at least one perfect imitation during the play session was approximately 20% prior to two years but 56% at 24 months.

The reader should note that imitative behavior in the "deferred" play session was not "pure" deferred imitation. Subjects were given opportunities to imitate the original target behavior during the original target phase, the differential phase, and the re-presentation of the target phase prior to the deferred assessment. Therefore, it was possible for a child to have "practiced" a given behavior three times before the deferred assessment phase. In contrast, a pure assessment of deferred behavior would not allow the subject to execute the behavior in the interval between modeling and assessment (see Experiment 4). Therefore, rates of deferred behaviors may not be accurate. However, it was of some interest to note that there were cases in which a child did not imitate the target behavior during the original target phase (and therefore did not receive the differential and re-presentation modelings), but nevertheless imitated it during the deferred or play session. While this did not occur often (any imitation during the deferred sessions was rare), it did occur. Pure tests of deferred imitation were made in Experiment 4.

Individual Differences

Conducting correlational analyses within a factorial design is

a problematic endeavor. A simple approach to examining the patterns of individual differences would be to correlate the variables of interest without regard to subject classification (e.g., sex, age, test form, experimenter, etc.). This strategy has the advantage of simplicity but the potential disadvantage that correlations may be different within subgroups or be influenced by average differences associated with these classification factors. For example, if imitation scores are higher for one experimenter than another, then ignoring experimenter will mean that some subjects will have high scores on a variety of imitation measures while others will have low scores on those variables. As a result, correlations between these variables will be observed, but they are due to different experimenters and do not necessarily imply that these variables are intrinsically related to one another.

An alternative approach is to calculate correlations within each cell of the subject classification matrix. This is ideal, but it requires large samples of subjects per cell to have confidence in the obtained correlations.

A third strategy is within-cell correlations--correlations calculated within each cell of the classification matrix and then pooled over cells to yield a single correlation per pair of variables. This approach has the advantages of coping with few numbers of subjects per cell and yielding a small number of correlations, but it has the potential disadvantage of obscuring differences in correlational patterns

that are associated with particular classification levels.

The decision of which statistical course to take also depends on the generality one desires. Within-cell correlations are essentially analogous to partial correlations--they represent the correlation between two variables with the effects of a classification factor partialed out. Such a result may or may not be appropriate to the research question and generalizable to useful populations. In contrast, ignoring the classification variable yields correlations that are generalizable to the population sampled in the study, although the conceptual source of the correlation is more obscure.

Our choice in the present study was to perform correlations separately within each age group but to ignore the classification variables of sex, experimenter, test form, etc. This policy was selected for two reasons. First, the data presented above indicate that while age was certainly an effective factor, the other classification variables did not interact with age or item type, variables of major interest in the correlational analyses. Therefore, it is likely that whatever correlations are influenced by these classification factors, such effects will not systematically alter the correlational results. Second, we were searching for patterns of relationship that could be generalized to subjects of the particular age groups we sampled <u>across</u> experimenter, sex, test form, etc. That is, correlations deserving interpretive emphasis should be apparent regardless of variation on these classification variables.

Relationships among target scale scores of different item categories. Of principal interest were the interrelationships among imitative behaviors for the seven item categories. The imitation scale scores for the original targets on these categories were factored with Varimax rotation separately at each age. Such analyses of the Fels and Berkeley data had revealed that items producing a sound product or clear perceptual consequence to their execution tended to cluster together on one factor while items producing a form product or a less distinct perceptual consequence clustered together on another factor. Although the results of the factor analyses of the present data differed somewhat from age to age, a common theme across age did emerge--a sound-product and a form-product factor. Table 9 presents the item loadings for these two types of factors at the four ages. Thus, there

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Insert Table 9 about here

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was a factor at each age on which the motor with sound product and/or coordinated sequences (which items also yielded sound products) received the highest loadings. Similarly, motor behavior with form product was assigned a high loading between 12 and 18 months of age on another factor. We regard this as a partial replication of the Fels-Berkeley results. Therefore, while infants do not tend to imitate form versus sound product items more frequently or at different levels of accuracy, individual differences do cluster, albeit weakly, around these themes.

Table 9. Factor Loadings for Original Target Scale Scores

	Age (months)			
	12	15	18	24
Sound Product Factor				
Motor/Sound Product	77	88	85	73
Coordinated Sequence	85			63
Motor/Object		81	83	
Social			78	74
Form Product Factor				
Motor/Form Product	83	78	81	
Social	-66	-84		
Vocal	-43		-85	

Correlations across assessment phase. Correlations were computed on the total number of imitations across all items between the various phases of the assessment program (see Table 7). The results are easily summarized. Correlations between the target, differential, and repeat-target phases were all very high because of procedural dependencies (a child was not given a differential or a re-presentation of the target unless a certain level of imitation was evidenced during the original target period). More pertinent to the issue of the generality of individual differences in imitation behavior were the correlations between these phases and imitation in the deferred and play phases. These correlations were low with one exception. The relationships between imitation during the differential and repeat-target phases on the one hand with imitation during the deferred and play phases on the other increased across age and reached statistical significance at 24 months of age (rs varying about .40). Moreover, when correlations across these phases were examined within the seven item categories, it appeared that this general relationship primarily derived from the coordinated sequence category.

These results make a cohesive point. There begins to be some generality of individual differences when behaviors require the symbolic abilities necessary to differentiate between various forms of a modeled behavior and defer execution of that behavior. The differential, repeat-target, and deferred phases plus the contrast between coordinated sequences and the six other item categories have been interpreted to involve such symbolic processes.

Correlations with parental education. Mean parental education was correlated both with original target scale scores separately for each of the seven item categories as well as with the summary imitation scores for the five phases separately at each of the four ages. Not one of the 48 correlations was significant.

Relations with siblings. The Fels data indicated a possible relationship between the presence of siblings and the likelihood that an infant imitates, especially if the siblings were 3-6 years older than the subject. Therefore, statistical tests comparing the presence vs. absence of siblings 0-3, 3-6, 6+ years older than the subject were conducted separately at each age using as a dependent variable the original target scale scores on the seven item categories as well as the summary scores for the five assessment phases. Only 1 of 144 such comparisons was significant.

Longitudinal Sample

If developmental change within individuals is the paramount question, then a longitudinal, not a cross-sectional, design is imperative (McCall, 1976-a; Wohlwill, 1973). Therefore, the cross-sectional 12-month sample reported above was followed longitudinally. However, because less than half the subjects had complete data across all four assessments, the small sample size precluded detailed examinations of test form, experimenter, and other control factors. In addition, the low frequencies of imitation in the deferred and play phases on such a small sample obviated statistical analyses. Nevertheless, the general character of the longitudinal results were so similar to those presented

for the cross-sectional study that a brief report of these data seems warranted.

Sample and Procedure

Sample. Of the 26 subjects seen in the cross-sectional study at 12 months, 8 boys and 4 girls were assessed at each of the four ages.

Procedure. The procedure was identical to that reported above for the cross-sectional sample, except that subjects were examined by a different experimenter with a different test form and order of item presentation on adjacent visits.

Results

The original target scale scores and the percent imitation during the original target, differential, and repeat-target phases were separately analyzed with Sex x Age x Item Category analyses of variance. These four analyses yielded almost identical results. All Age and Item Category main effects were significant at far less than $p < .001$. In addition, the Age x Item Category interaction was significant ($p < .01$) for each dependent variable except the percent imitation during the repeat-target phase. There were no main effects or interactions for sex ($Fs < 1$). These statistical outcomes were nearly identical to those observed for the cross-sectional samples.

The percent imitation during the original target, differential, and repeat-target phases for this longitudinal sample is presented as a function of age in Figure 7. These results are remarkably similar

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Insert Figures 7 and 8 about here

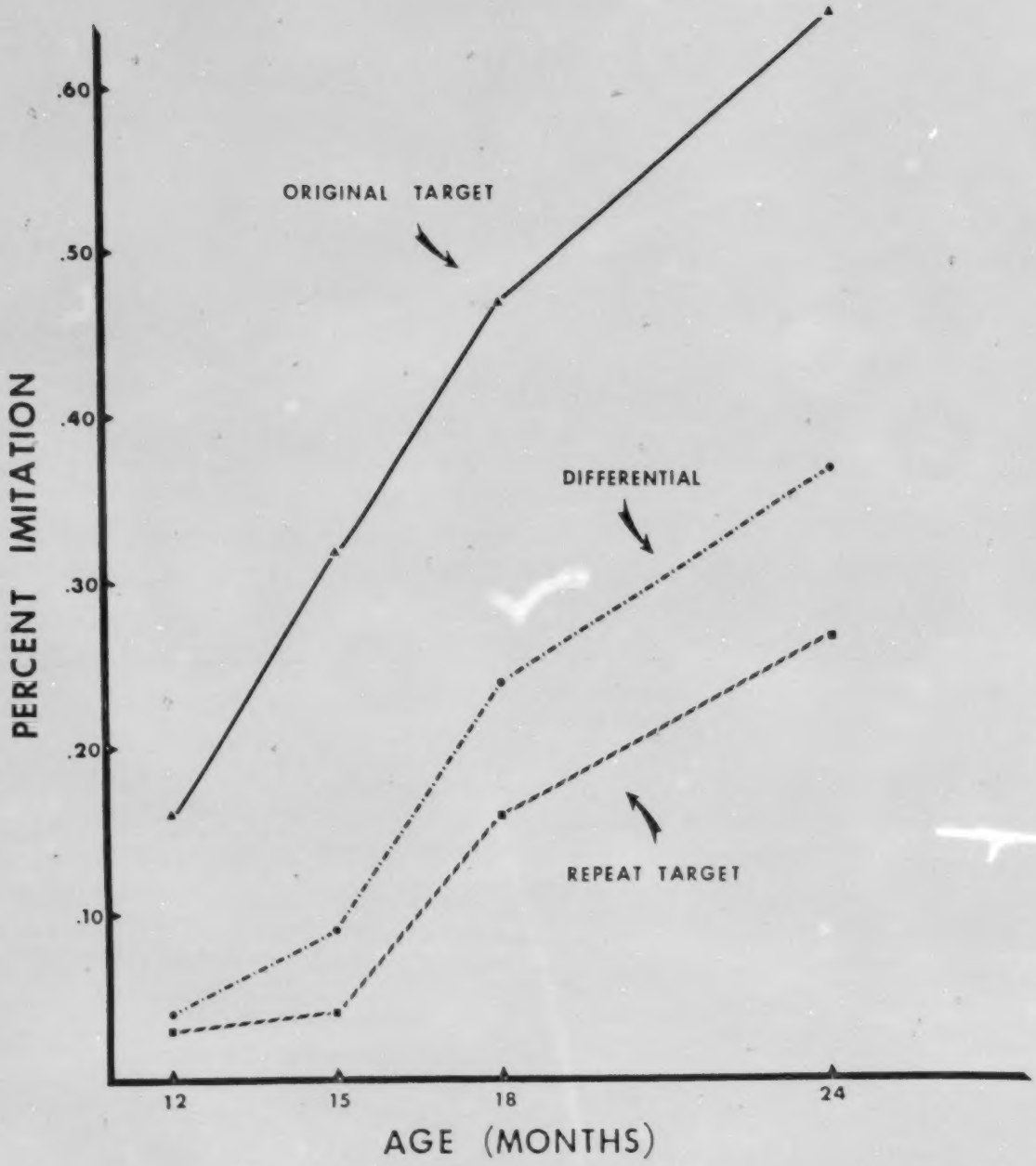
.60
.50
.40
.30
.20
.10
PERCENT IMITATION
ORIGINAL TARGET
DIFFERENTIAL
REPEAT TARGET
12
15
18
24
AGE (MONTHS)

Figure 7

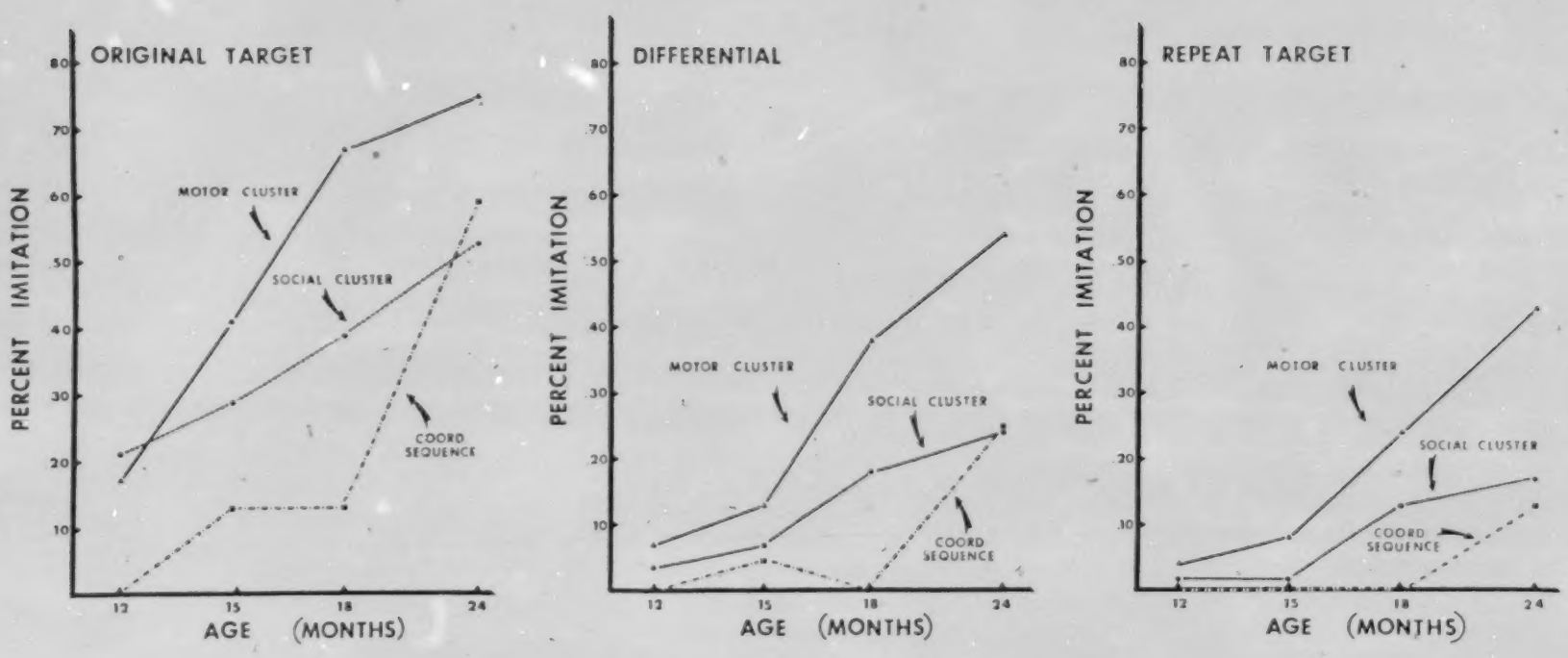
ORIGINAL TARGET
PERCENT IMITATION
80
70
60
50
40
30
20
10
MOTOR CLUSTER
SOCIAL CLUSTER
COORD SEQUENCE
12
15
18
24
AGE (MONTHS)
DIFFERENTIAL
PERCENT IMITATION
MOTOR CLUSTER
SOCIAL CLUSTER
COORD SEQUENCE
AGE (MONTHS)
REPEAT TARGET
PERCENT IMITATION
MOTOR CLUSTER
SOCIAL CLUSTER
COORD SEQUENCE
AGE (MONTHS)

Figure 8

in both level and pattern to those presented for the cross-sectional samples in Figure 4. Again, original target performance increased in a linear fashion across age, whereas the likelihood of an imitation during differential and repeat-target periods did not begin to show substantial improvement until 18 months. The reader may note that the level of performance is nearly identical between longitudinal and cross-sectional samples. Apparently, there is little evidence for repeated testing, cohort, or subject selection effects operating in these samples.

Figure 8 presents percent perfect imitation as a function of age and motor, social, and coordinated sequence clusters for the original target, differential, and repeat-target phases. Again, the data are remarkably consistent with the cross-sectional sample presented in Figure 5 with respect to pattern and level of imitative performance. Most notable is the fact that coordinated sequences did not show substantial levels of imitation in any phase until 24 months of age, a result consistent with conclusions drawn from the cross-sectional samples pertaining to the emergence of symbolic abilities between 18 and 24 months of age.

Conclusions

Summary of Results

The analysis of imitation-like items from the Gesell and California infant tests using the Fels and Berkeley longitudinal protocols plus cross-sectional and longitudinal studies of imitation in 12-24-month infants produced the following results:

1. Given the infant testing context and a strange adult model, 12-month infants perfectly imitated 28% of the simple, single-unit motor behaviors. The trend increased linearly through 24 months of age when 76% of these elementary motor acts were imitated.

2. The developmental trend for simple behaviors involving direct social interaction with the examiner was also linear, but the developmental slope was lower, rising from 21% at 12 months to 45% at 24 months of life.

3. For behaviors involving a coordinated sequence of two motor acts, there was essentially no perfect imitation at 12 or 15 months (5-6%), but the probability increased thereafter, reaching 24% at 18 months and 59% at 24 months.

4. For simple, single-unit motor and social acts, there were very few responses (11%) that were imperfect approximations to the target behavior. That is, imitation was essentially all-or-none; either subjects imitated the modeled target perfectly or they did nothing systematically related to the modeled behavior. The development of imitation was simply a rise in the percentage of infants perfectly imitating the target; the accuracy of imitation did not change with age.

5. In contrast to these single-unit behaviors, infants did display approximate imitations of coordinated sequences, especially at the younger ages when approximations increased to 52% at 18 months. We believe that younger infants had trouble encoding, remembering,

and/or invoking the association between the two behavioral units required of a coordinated sequence until certain cognitive advances emerged between 18 and 24 months.

6. In accord with results reported by others, gestural imitation occurred more frequently than vocal imitation.

7. While the probability of imitating immediately after modeling a behavior increased linearly across age, subjects did not begin to imitate a differential target (deviating slightly from the original target) until 15-18 months, and they only began to imitate the representation of the original target following this differential assessment at approximately 18 months. Finally, imitation of modeled targets in a deferred setting (either the same assessment context or a free play session) only reached substantive levels by 24 months of age. Within each of these phases, the imitation of single-unit motor and social behaviors was more advanced than the imitation of coordinated sequences. We interpret these results to indicate that as the informational character of the behavior or testing situation increases, imitative performance will be correspondingly delayed. Moreover, these data are remarkably consistent with recent theorizing regarding the emergence of entity-entity associations and the symbolic function derived from infant mental test items (McCall, 1976-b, Note 9; McCall et al., 1977).

8. There were no sex differences in the above results, and the major trends for age, item category, and assessment phase (i.e.,

original, differential, deferred) described above were not qualified by (i.e., were general across) particular examiner and test form.

9. The correlations between imitative performance on one type of item and that on another type were generally very low. However, there was a tendency for individual differences to be correlated for behaviors that produced distinct perceptual consequences (e.g., sound products) and separately for behaviors that produced less distinct consequences (e.g., form products). No mean differences in the propensity to imitate those two classes of items were observed.

10. The propensity to imitate a set of varied behaviors revealed some stability across short time intervals. The month-to-month rs were in the .40's between 10 and 12 months, in the .50's between 12 and 13 months, and in the .60's and .70's at 13 and 14 months. Correlations across three or more months were quite low.

11. There was a growing relationship between performance during the differential and repeat-target phases on the one hand and deferred imitation, especially for coordinated sequence items, on the other. This result may signify that when imitative behavior involves some degree of symbolic functioning, correlations across situations can be found.

12. No relationships were found between imitation and parental education.

13. There was some indication in the Fels data that imitation of sound producing actions might be related to the presence of a sibling,

especially one that was 3-6 years older than the subject, but that such an effect might be opposite for males and females. This finding was not replicated in a second study.

14. There were no relationships between the initial social apprehension displayed by the infant to the strange assessment context or examiner and subsequent imitative performance.

Implications

These data suggest that the 12-month infant is capable in a perceptual-cognitive sense to imitate simple, single-unit behaviors, and such imitation is not artifactually attributable to spontaneous displays of the target behavior. Moreover, when imitation occurs, it is essentially a perfect replica of the modeled target (all behaviors modeled in the present study were within the physical capacity of the subjects). Reports that very young infants do not imitate a simple behavior perfectly but show progressive approximations to the target with age (e.g., Kaye, Note 6; Kaye & Marcus, Note 2; Uzgiris, 1972), have relied on subjects younger than one year.

However, while 12-month infants are capable of imitating elementary behaviors, they did not do so with outstanding frequency. Even elementary motor acts, the most imitated behaviors, were perfectly copied on only 28% of the occasions at 12 months. This figure reached 76% by 24 months, but it is not clear what developmental achievements are responsible for this increase in frequency. The prerequisite cognition seems to be available; therefore, whether an infant imitates

may be a motivational issue. Consequently, as in other areas, investigators of imitation in infants must also be mindful of the distinction between capacity and performance.

One set of motivational parameters may be associated with the nature of the modeled behavior. Simple motor acts were imitated most while behaviors requiring direct social interactions with the examiner (including vocal behaviors) were performed less often. Also, while the clarity of the perceptual consequence of a given behavior did not seem to affect the probability of imitation, it did influence the correlational pattern of individual differences. Another motivational factor, the child's social apprehension in the strange experimental context and with a strange examiner, was not associated with imitative performance.

In addition, other variables suspected of relating to the imitative performance of older children might be examined--age, sex, and familiarity of the model; rewards accruing to the model; the infant's perception of the model's status; and the appropriateness of the modeled behaviors for the child's ongoing behavior. The latter factor is not often considered with older children, but it may be crucial when toddlers are the subjects. The expressive behavioral repertoire of older children is considerably larger and more flexible than that of 2-year-olds. If we make the reasonable assumption that people do not imitate willy-nilly but only when the target behavior is appropriate to the contemporary situation and is potentially useful in achieving

behavioral goals at a given moment, then we might expect older infants to fit a given observed behavior into their ongoing stream of behavior more easily than younger children.

Our data also suggest that while the year-old infant is capable of imitating, restrictive circumstances make it unlikely that infants will do much imitating in naturalistic environments. For example, a limiting condition on the likelihood of imitation for 12-15-month infants is their apparent inability to defer imitative performance. Our subjects were able to execute the target behavior with their own set of toys immediately upon viewing the model; when the same objects were made available a few minutes later or in a subsequent free play session, imitation was rare among 12-15-month subjects. This finding is consistent with Piaget's (1951) thoughts on deferred imitation and the symbolic function, and suggests that unless a child has the materials available immediately after observing a given behavior, imitation is unlikely until the middle of the second year.

Another limitation is that the target behavior must be simple and unitary rather than an integrated series of acts. Coordinated sequences of two simple motor acts were not imitated accurately at 12 or 15 months, although these infants tried, and deferred imitation of such sequences did not emerge until 24 months and then only in modest amounts. Therefore, single acts upon an object may be imitated by

12-15-month infants, but deferred imitation of these simple behaviors or immediate imitation of a two-unit sequence is not likely until after 15 months. Moreover, real flexibility of imitative performance, both in terms of the variety and complexity of behaviors that will be imitated and the relative lack of time constraints on the deferral of performance following modeling, is not achieved until approximately two years of age. Having said that, however, one must acknowledge that the age at which children can perform a specified act depends heavily on the parameters of assessment, and a definite age prescription is premature at this stage of research. In the home with more interesting toys, such behaviors may occur with considerable frequency at much younger ages.

Our data also speak against a pervasive, enduring trait of "imitativeness." Correlations across items or item types were quite small and while the stability of individual differences on total scores or individual item types from month to month increased from approximately .40 to .75 between 10 and 14 months, correlations across spans of three or more months were trivial. However, when symbolic abilities were required to imitate (e.g., in 24-month subjects), correlations across situations within an age did emerge. Therefore, at least prior to two years of age, there does not appear to be an enduring trait of imitativeness, implying that situational and stimulus factors as well as developmental changes in cognitive and motivational variables govern this behavior to a significant

extent. However, by 24 months, some generality of individual differences may be observed in imitative behavior involving symbolic activities.

CHAPTER III. IMITATION OF TELEVISED MODELS

The previous study indicated that children in the second year of life can and occasionally will imitate the behavior of a strange adult, and this is especially true as they reach their second birthday. However, the results also indicated that deferred imitation--imitating a model observed at some previous time--did not occur often until two years of age. The next study in our project was guided by two general themes: A practical concern for whether infants in the second and third year of life would also imitate a televised model and the pursuit of circumstances which promote imitative performance.

Experiment 3: Live Versus Televised Modeling for Infants 18-36 Months of Age

Young children, even those in the first two or three years of life, are exposed to a considerable amount of commercial television programming. Broadcasting Yearbook (1971) reports TV sets are on 6 hours per day in the average American home. Moreover, older brothers and sisters who watch currently popular children's shows may encourage their younger siblings to join them. The previous study indicated at least two major limitations on the infant's likelihood of imitating observed behavior: (1) children younger than two years of age may not be able to defer performance very long following the observation of the model, and (2) coordinated sequences of behaviors are not likely to be imitated before the age of 18 months, if performance immediately follows modeling, and not before 24 months if the interval is longer. Acknowledging these restrictions,

one nevertheless observes that some of the educational content presented on children's programs (e.g., Sesame Street) could potentially be learned by children 2-3 years of age. For example, children of these ages can acquire the vocabulary of geometric shapes, recite the alphabet, and count. Is it possible for children between 18 and 36 months of life to learn simple behaviors from a televised model, and is there much difference in the probability of imitating as a function of whether the model is televised or live?

Although approximately three out of four simple behaviors modeled were imitated by two-year-old children in the previous study, we felt infants were capable of performing at higher rates, especially the younger subjects. For example, some appeared befuddled by the assessment procedure and seemed not to know what to do at first (verbal instructions or encouragement were not permitted in an attempt to ensure that performance indeed reflected observational learning or imitation). Therefore, we wondered if infants were able to reproduce the modeled behavior more frequently and at younger ages if they were simply told to do so. If this were the case, then observational learning and performance of 2-3-year-olds in naturalistic circumstances might be increased if television characters instructed young viewers to imitate behaviors displayed on children's educational television.

But performance might have lagged behind its potential for another reason. The single-unit behaviors were relatively simple and eventually boring. That is, once a child saw or imitated a behavior,

there was little uncertainty left in what the object would do after such an experience; therefore, we speculated that deferred imitation might be increased if subjects could be made more interested in the stimulus materials. We assumed that when children are interested in, but uncertain about, the nature of an object, they are most likely to rely on observed experiences to guide their behavior and exploration of such a stimulus. Therefore, we included a play session following the modeling/imitation assessment in which half the toys were identical to those used in the modeling phase, while the other half were moderate transformations in form and color of toys previously seen. It was presumed that these moderate discrepancies would elicit the child's interest (McCall & McGhee, 1976; Weisler & McCall, 1976), while at the same time be similar enough to the modeled toys to evoke memories of the model's behavior. Therefore, the prediction was that deferred imitation would be greater for the transformed than for the original objects.

Finally, the literature on television and behavior indicates that children with certain personality and social dispositions are more likely to be influenced by television fare than are other children (Akamatsu & Thelen, 1974). Therefore, we instituted a crude and preliminary assessment of the relationships between television viewing habits and mother-reported temperamental characteristics on the one hand and the child's propensity to imitate live or televised models on the other.

We assessed children 18, 24, and 36 months of age in the current study. These ages were used because of our interest in deferred imitation, the need to use more interesting and therefore complicated behaviors as targets, and the possibility that it may be more difficult for a child to imitate a televised than a live model.

Method

Subjects

Subjects were recruited in the same manner as described for Experiment 2. A total sample of 96 was selected, half males and half females, distributed evenly across the ages of 18, 24, and 36 months. Thirty-nine other subjects were seen but did not finish the session either as a function of equipment and procedural errors, fretting, or lack of cooperation. Generally, the predominantly white sample came from homes where the mid-parent education included some college, approximately one out of three were only children at the time of the assessment, and all but a few children came from homes having a television set. However, approximately 1/3 of the sample had never seen a black and white television (the television used in the study was black and white). Details of the sample are given in Table 10.

Insert Table 10 about here

Materials

Imitation items. Whereas a major focus of the previous study was on the nature of the behaviors to be imitated, this was of rela-

Table 10. Subject Characteristics for Experiment 3

Attribute	Age (Months) 18	24	36
N (Males)	16	16	16
N (Females)	16	16	16
Midparent Education*	5.20	5.18	5.15
Percent only child	41%	34%	28%
Blacks	2	1	1
Number pregnancy, delivery, child health problems	0	2	3
Number non-normal birth position**	4	7	2
Percent exposed to some black-white TV	69%	47%	62%
Percent exposed only to color TV	25%	50%	38%
Percent exposed to no TV	6%	3%	0%

* 4 = high school graduate, 5 = some college experience, 6 = college graduate

** Breech, transverse, Caesarian, etc.

tively little interest in the current experiment. Rather, the criterion for item selection was the interest value and appropriateness of the target behaviors for 18- to 36-month infants. Therefore, the items tended to be coordinated sequences of actions producing an obvious stimulus consequence. Some verbal items were also included, because we felt they may be more interesting to the three-year-olds than for the younger subjects seen in the previous research.

The materials are shown in Figure 9 and details of the target behaviors are presented in Table 11. For each item, the table describes

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Insert Table 11 and Figure 9 about here

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the materials, the target behavior modeled by E, and a transformation of the original materials which represented a moderate discrepancy in form or color from the original stimuli and was used in the play session. There were eight primary target stimuli composing the assessment battery, plus four alternate items that were potentially included if an infant spontaneously imitated a primary item before modeling.

Television questionnaire. Since 18- to 36-month infants undoubtedly have varying degrees of experience with television and with black and white versus color sets, information on the child's viewing experience was obtained as a potential correlate of imitative behavior. The most pertinent questions asked of the parents were: (1) Can you estimate how much time your child spends actually watching television programs in an average day? (2) What are the television programs that

Table 11. Imitation Items for Experiment 3

Original Target Items

Puzzle

Stimuli. Two L-shaped wooden pieces (20.5 and 12.5 cm outside leg lengths, 3.7 cm wide, and 1.9 cm thick), painted blue on one side, green on the other side, and red on the edges; and one 8.8 x 12.6 cm rectangular piece painted red on all surfaces.

Target. E places one L-shaped piece on the table, fits the rectangular piece into the inside angle of the L, and places the other L upside down to form a large rectangular puzzle.

Transformation. Two wooden semicircular blocks (22 x 2.5 x 1.5 cm) painted red on one side, yellow on the other side, and blue edges; and a circular piece (10 x 1.6 cm) with two rectangular protrusions painted green.

Animals

Stimuli. Plastic, realistically formed, brown, 6 cm (shoulder height) horse; and brown and white 5.6 cm cow whose legs, head, and tail can be made to rotate forward and back.

Target. E places the cow and horse in a standing position facing each other and says, "My cow is going to talk to my horse--Moo, Moo."

Transformation. Small nonmoveable plastic black and white cow (3.5 cm shoulder height) and a dark brown horse (2.8 cm shoulder height).

Coil

Stimuli. A shiny, gold, 18-loop letter holder coil (12 x 6 cm) mounted on a blue, wooden, 18 x 10.2 cm wooden base; and a set of three red, white, and green plastic keys on a silver chain.

Table 11 (continued)

Target. E picks up the red key and, while holding the base in one hand, rubs the key tip horizontally over the coil to produce a sound.

Transformation. A pink 17.7 cm plastic coil mounted on a 21.6 cm red wooden base; and a 34.5 cm long plastic dowel.

Ring and Box

Stimuli. A 12.5 x 12.5 x 10.0 cm green plastic box and a 23 cm white plastic cord .5 cm in diameter attached to a rounded, red wooden block 4.9 cm in diameter and 1.9 cm thick.

Target. E holds the free end of the cord and rotates it while the red block is inside the green plastic box, striking each inside panel of the box in turn.

Transformation. A 12.5 x 12.5 x 10.0 pink plastic box and 23 cm white plastic cord .5 cm in diameter attached to a square green wooden block 4.9 cm x 1.9 cm thick.

Slide and Golf Ball

Stimuli. Two 7.5 x 3.6 x 3.6 cm green rectangular blocks; one 16.5 x 3.6 x 3.6 cm yellow block; a red, bounded, furrowed trough 33 cm long and 4 cm. wide; and a white plastic practice golf ball with holes in it, 4 cm in diameter.

Target. E places the two small green blocks parallel to one another on the table, positions the longer block on top of the two blocks and perpendicular to their orientation, rests one end of the trough on top of this stack of blocks, places the golf ball at the top of the trough and lets it roll down the incline to the bounded end.

Transformation. A blue, bounded, furrowed trough 33 cm long and 4 cm wide; one 14 x 3.6 x 3.6 cm yellow sponge block; two round, blue sponges 33 cm in diameter; and a red rubber ball 4 cm in diameter.

Table 11 (continued)

Rocking Block

Stimuli. A semicircular blue block, 25.5 cm in maximum diameter, 9.9 cm high, and 4.5 cm thick with 7 facets on the rounded side to prevent the block from rocking spontaneously when placed on its edge.

Target. The block is set on its circular edge and the E depresses one end of the block as far as possible and then releases it, causing the block to rock back and forth.

Transformation. A semicircular yellow block 25.5 cm in maximum diameter, 9.9 cm high, and 4.5 cm thick with 7 facets on the rounded side to prevent the block from rocking spontaneously when placed on its edge.

Bell-Block and Dowel

Stimuli. A 7.1 cm diameter Fisher-Price blue plastic circular block filled with bells with a 1.8 cm hole in the middle, and a 1.8 x 32 cm yellow dowel.

Target. E picks up the bell-block and inserts the dowel in the center hole, grasps both ends of the dowel, one in each hand, and alternately raises one end and then the other causing the block to slide back and forth along the dowel and make a noise.

Transformation. A 6.5 x 6.5 cm Fisher-Price plastic triangular block filled with bells, with a 1.8 cm hole in the middle and a 11.0 x 32 cm striped plastic straw.

Table 11 (continued)

Doll

Stimuli. Two 10 x 1.7 cm rectangular green blocks; 1 blonde, blue-eyed rubber and plastic doll (13 cm high) with blue flowered diaper; and 1 blue flowered blanket (11.5 x 11.5 cm).

Target. E takes green blocks and places them side by side on the table, picks up doll and lays it on green blocks, picks up cover and places it over the doll, pats doll, and says "nighty-night."

Transformation. One green block, 19 cm long x 7.1 cm high, which has been carved to look like a bed with head and foot boards; one pink piece of cloth 18.5 cm long, attached under the head and foot boards to form a hammock type bed; one blonde, black-eyed rubber doll dressed in pink; and one yellow triangular shaped blanket 14.0 x 9.5 cm.

Alternate Items

Pinwheel

Stimuli. A plastic, orange and white pinwheel (18.7 cm maximum diameter) with silver wheel at its center, mounted on a cream colored 17.5 cm plastic stick.

Target. E holds pinwheel by the stick and blows in an exaggerated manner twice to make the pinwheel move.

Transformation. A plastic red and green pinwheel (18.5 cm maximum diameter) mounted on a blue wooden dowel 11.5 cm long. The dowel is fastened to a blue wooden base 4.5 cm in diameter.

Nesting Sponges

Stimuli One rectangular, yellow plastic box 12.5 cm square and 2.5 cm deep and two triangular, flesh-colored sponges which can be placed together at the hypotenuse and fit into the box.

Table 11 (continued

Target. E places first one and then the other triangular sponge into the box, hypotenuse to hypotenuse.

Transformation. Two yellow semicircular sponges 11.5 cm in diameter and a red circular tin can 12.5 cm in diameter and 3.8 cm deep.

Springboard with Ring

Stimuli. A 12.6 x 10.1 x 4.5 cm yellow wooden block with a 6.5 cm peg projecting up from its surface at one end. The peg protrudes through a red spring-loaded lever such that when a gold ring, 3.8 cm in diameter attached to the base with a string, is looped over this peg, a sharp depression of the lever can flip it off.

Target. E places the gold ring over the peg and strikes the springboard with a finger causing the ring to fly off the peg.

Transformation. A 10.0 cm x 12.5 cm green wooden block with a yellow 12.2 cm wood catapult attached and a 2.5 cm red ball with a string 34 cm long attached through the center of the ball and tied to the green block with an eye screw.

Spinner

Stimuli. Two triangular-shaped blue blocks (8 cm base, 11 cm high) with a 2.5 x 1.2 cm notch cut in the apex, mounted vertically (notch up) at the ends of a 15.5 x 7.6 cm rectangular base; a .9 cm red dowel 18 cm long which can rest in the notches of the base; and a multicolored spinner consisting of a 4-fan star-like piece, 15.3 cm in maximum diameter, with a 1.1 cm hole in the center.

Table 11 (continued)

Target. E places the notched-triangular-block base on table, puts the dowel through the hole in the spinner, rests the dowel with the mounted spinner into the notches of the base, and twirls the spinner by hand.

Transformation. Two semicircular red blocks (7.5 cm long x 11.9 cm high x 1.5 cm wide) attached by means of two 10.8 cm dowels braced against the two red blocks having a 1.5 cm notch at top center, and a 15.6 x .8 cm blue dowel, a green 4-fan-star-like piece with a 1.3 cm hole in the center.

Sheep and Pig

Stimuli. One white sheep (3.8 cm shoulder height) with black ears, legs, nose and eyes; moveable legs and head. One black pig (2.7 cm shoulder height) with white ears and eyes; moveable legs and head.

Target. E places pig and sheep in a standing position facing each other and says, "My sheep is going to talk to my pig--Baa, Baa."

Transformation. One white sheep with horns (2.1 cm. shoulder height) with no moveable parts. One pink pig (2.0 cm shoulder height) with no moveable parts.

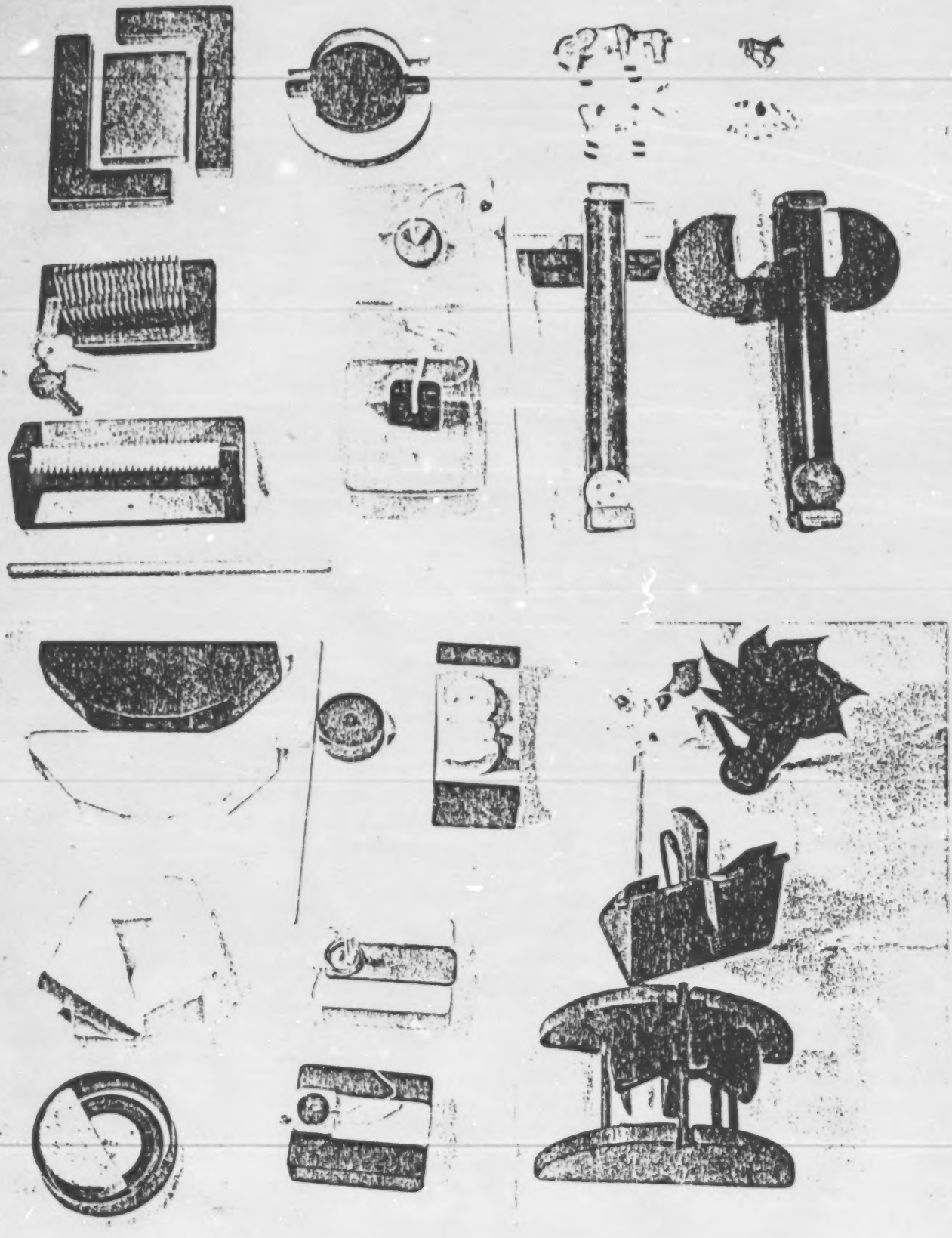

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Figure 9

your child watches most frequently?

Temperamental questionnaire. Since the literature on television and behavior in older children suggests a relationship between personality and social behavior of the child on the one hand and viewing habits and response to television programming on the other, a questionnaire concerning the child's temperament was administered to the parent attending the assessment. The items were selected and modifed from the unpublished interview, Child Behavior Toward Parent Inventory, by Earl S. Schaefer and May Aaronson. The 35 items used in the present study are listed in Table 12. No attempt was made to be faithful to

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Insert Table 12 about here

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the characteristics or wording of Schaefer and Aaronson's original items, and no reliability or validity evaluations were made of the final scale. Rather, we accepted the parent's response to our questions at face value and considered it a sample of parent-report behavior to be related to imitation measures without inferring or generalizing to broader dimensions of child temperament, personality, and social behavior.

Procedure

The observations were made in a large mobile laboratory parked at shopping centers in Springfield and Dayton, Ohio. Three research assistants participated. One observed behaviors from behind a one-way mirror and operated the television equipment. Another, a female (sym-

Table 12. Infant Behavior Inventory (Modified from Schaefer and Aaronson)

Instructions: Please describe as accurately as you can the behavior of your child by circling one and only one of the six possible responses to each item on the following pages.

My child is

6 - Exactly like this

5 - Quite a bit like this

4 - Slightly like this

3 - Slightly opposite this

2 - Quite a bit opposite this

1 - Exactly opposite this

In the case of items relating to behaviors which you have not observed, respond as you would expect your child to behave as a general rule. Please recheck at the end to make certain that every item has been marked.

1. Will talk or babble to you about his/her toys, clothes, what he/she is doing, etc.
2. Readily responds with a smile to a friendly person.
3. Tries a toy out in many different ways, always curious as to what he/she can get it to do.
4. Easily loses interest in what he/she has started doing; goes from one thing to another.
5. Centers his/her attention on what he/she is doing; not easily distracted.
6. Shies away from anything strange and different.
7. Watches and follows what you are doing when shown how a toy works, how it moves, makes sounds, etc.

Table 12 (continued)

8. Is a talkative child, expressing himself/herself through language or near-language on every occasion.
9. Shows a warm and/or friendly disposition to one who plays with or generally tries to please him/her.
10. Likes to feel, smell, taste, pound, squeeze,or in other ways examine new articles and toys.
11. Goes rather quickly from one object or activity to another.
12. Gives long attention to objects, toys or books that interest him/her.
13. Is timid and fearful about handling and examining strange objects; needs considerable time before he/she will touch them.
14. Readily looks toward you when you call to him/her or call his/her name.
15. Readily talks or babbles to you when you come near and/or pay attention to him/her.
16. Draws close to one who shows him/her affection or approval.
17. Is attracted to and examines with interest the objects and materials in his/her environment.
18. Switches from one activity to another frequently.
19. Is very good at directing his/her attention and interest toward a single object or activity.
20. Is afraid to approach or touch insects, dogs, cats, or other animals.
21. Responds readily when an effort is made to get his/her attention.
22. Will readily talk or vocalize if you encourage him/her or show some interest.

Table 12 (continued)

23. Readily shows you what he/she is doing or making, or the toy he/she is playing with.
24. Tracks down noises, voices and activities to see what's going on.
25. Seems to forget what he/she was doing and goes on to something else, upon the slightest distraction or interference.
26. Is able to focus his/her attention for a rather considerable time on something he/she is trying to do.
27. Is afraid to get near moving toys, noisy toys, balloons, or other strange or unusual objects.
28. Directs his/her attention to a picture or other limited area, upon request.
29. Uses words or vocalizations to express his/her desires, rather than merely using gestures and facial expressions.
30. Enjoys being played with.
31. Points inquiringly to objects, asks questions if he/she is able.
32. Rarely maintains interest in a game or activity for very long.
33. Gets so absorbed in a task, he/she hardly notices activities and distractions around him/her.
34. Is afraid to engage in activities using such equipment as slides, swings, merry-go-rounds, rides, etc.
35. Attends to person who tries to socialize with him/her.

bolized by M), modeled the behaviors in the live and television conditions, and a third female (symbolized by E) handed the stimuli to the subject and returned them to a cabinet after an item was finished.

Adaptation. The session began with the subject on the parent's lap while the general procedures were described. The television questionnaire was administered verbally at this time, and the parent was also given a copy of the behavior inventory (Table 12) to be filled out later while the subject was being assessed.

The E sat on the floor with a slinky and a xylophone, called Ss attention to the toys, indicated that they could be played with, and busied herself with manipulating the toys. If E spent more than two minutes playing with the toys before S joined her, E verbally encouraged S to do so. The adaptation phase was completed after a minimum of 5 minutes of play in which S and E freely exchanged toys or after 20 minutes, whichever occurred first.

Imitation assessment. When the adaptation phase was completed, S was placed in a highchair at a small table. The model (live or TV) was situated directly across from S, and E was at the table to S's right. The parent sat approximately 5 feet to the rear and left of S and was instructed to remain natural and politely responsive to any solicitation by S (e.g., smile, minimally acknowledge the child possesses or did something, but not to encourage or instruct S to pick up toys or to play in a given way).

As soon as S was comfortable and facing the model, the first item was presented in three phases--spontaneous play, modeling, and imitation. During spontaneous play the materials were simply placed on the table in front of S who was allowed to freely play with them until (a) contact with the toys ceased, (b) the toys were held without manipulation for 5 consecutive seconds, or (c) the S actively indicated lack of interest in the object (e.g., motions, vocalizes, or verbally requests E to change toys).

After spontaneous play, modeling began. In the TV modeling condition, E said, "(child's name), look at the lady on TV. She has a toy just like yours." E pointed to the television and, if necessary, repeated these words to get S to look at the blank television screen. Once that was accomplished, the modeling sequence began on video tape and ran uninterrupted. The modeling sequence consisted of a display of the target behavior, a disassembling of the target object, and a second display of the target. The TV screen went blank between items. The TV presentation began with a distant shot of the model who verbally stated that she had some toys. When the actual manipulation of the objects began, the tabloid shifted to as close a shot as possible of the modeled behavior (typically M's hands and the stimuli), followed by a distance shot of the model disassembling the toys.

Modeling in the live condition was as similar to the televised circumstance as possible (including having the same model and the same verbiage), except that the stimuli were handed to and retrieved from M by E, and

M did not disappear between test items. Throughout the session, the live model did not interact socially with the S. In contrast, E presented, removed, and adjusted all stimulus materials--the M simply sat and modeled the targets. While the E remained pleasant and warm, she offered no specific reward (or punishment) for imitating. When the child was finished with the toy set or imitated the behavior, the E was permitted to say, "All finished?", "Here are some other toys," "I'll take those," etc., but not "O.K.," "Good, you did it," or "Did you like those?"

In addition to live vs. televised modeling, another independent variable was whether the subjects were instructed to imitate or not. For the instruction condition, the M said, "Can you do this?" before the first modeling; "You do this," after the first modeling; and the same two sentences before and after the second modeling, respectively. These statements were simply omitted in the no instruction condition.

After two displays of the target behavior, the S was allowed to imitate or play with the objects until (a) active manipulation ceased for 3 consecutive seconds, (b) S indicated with gestures, vocalizations, or words that he/she was finished, (c) S imitated the target behavior perfectly, or (d) 30 seconds, whichever came first. When this criterion was reached, the toys were removed and the next item in the series was immediately presented.

Deferred play session. After the imitation assessment, the S was given a play session with eight toys. Four of the toys were

Table 13. Details of Item Presentation in Experiment 3

Order I		Deferred Play	
Target Item	Alternate	Form A	Form B
1. Rocking Block	Pinwheel	Original	Transformed
2. Ring and Box	Springboard and Ring	Transformed	Original
3. Cow & Horse	Sheep & Pig	Original	Transformed
4. Puzzle	Nesting Sponges	Transformed	Original
5. Slide & Golf Ball	Spinner	Original	Transformed
6. Coil	Springboard & Ring	Transformed	Original
7. Doll	Sheep & Pig	Original	Transformed
8. Bell-Block & Dowel	Pinwheel	Transformed	Original

Order II		Deferred Play	
Target Item	Alternate	Form A	Form B
1. Bell-Block & Dowel	Pinwheel	Original	Transformed
2. Coil	Springboard & Ring	Transformed	Original
3. Slide & Golf Ball	Spinner	Original	Transformed
4. Doll	Sheep & Pig	Transformed	Original
5. Ring & Box	Springboard & Ring	Original	Transformed
6. Puzzle	Nesting Sponges	Transformed	Original
7. Cow & Horse	Sheep & Pig	Original	Transformed
8. Rocking Block	Pinwheel	Transformed	Original

identical to those used in the imitation assessment while the other four were moderate transformations in form and color of the remaining four original objects (see Table 11 for details). The play session lasted 10 minutes or until the child failed to manipulatively interact with the toys or room fixtures for 30 consecutive seconds.

Counterbalancing. Table 13 gives the details of item presenta-

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Insert Table 13 about here

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tion. The eight target items were the same for all subjects, but they were administered in two orders. Each target item was paired with a specific alternate item matched in general form and content with the original. The alternate was substituted for the original target if S spontaneously displayed the target behavior before modeling. For each of the two orders, the subject was given one of two sets of toys in the play session. These two sets consisted of four of the original and four transformations of the original objects. For subjects spontaneously displaying the target, the original or transformation of the alternate was available in the play session.

Independent variables. The major independent variables were age (18, 24, 36 months), the type of model (live versus TV), and instructions (instructions to imitate versus no instructions to imitate). In the deferred play session, an additional comparison was made between the original and transformed toys. Moreover, control variables included the sex of subject, the order of item presentation in the

imitation assessment, and the specific toy set in the play session.

Dependent Variables

Adaptation. Because the previous experiment indicated no relationship between the length of adaptation and imitative behavior, no measures were taken during this phase.

Imitation assessment. Our electronic capability was limited, so once the modeling sequence began it ran continuously regardless of the infant's behavior. To ensure proper experimental control, the live condition had to be run in a similar fashion. Consequently, it was possible for an infant not to visually attend to the modeling of a specific behavior. Therefore, an observer scored whether or not the infant saw all aspects of a target behavior at least once (even if one aspect was attended to in one of the modeling displays while another aspect was viewed during the second display).

A scoring scheme was developed separately for each target and alternate item which objectively defined up to 10 levels of the precision of imitation. Each item was scored according to its unique scale, but that information was then distilled to a 4-point scale appropriate across all items: 1 = no manipulation with the stimulus materials, 2 = did not modify manipulative contact with the objects as a function of the model, 3 = evidenced some imitation or progressively closer approximations to the target behavior but the performance was not perfect, and 4 = imitated the target perfectly.

Deferred play. The length of time with each object was recorded, and the number and nature of each imitative behavior was scored according to the scales described above. These measures were separately combined across the four identical and four transformed toys.

Results

Spontaneous behaviors. Of the 768 items administered in the study, 21 (or 2.7%) were spontaneously exhibited prior to modeling, thus requiring an alternate item. As in the previous study, older children displayed more spontaneous targets than younger Ss (3, 5, 13 at 18, 24, and 36 months, respectively), and twice as many spontaneous targets occurred in the television than in the live model condition. The latter effect does not appear to derive from exploration of the objects out of boredom, since all but one spontaneous display was followed by a complete watching of the model's performance with those materials. There were no obvious differences associated with the instruction manipulation, the sex of subject, or the chromatic/achromatic character of the child's home television. More than half of the spontaneous targets were displayed for the rocking block and the ring and box items, and no child spontaneously exhibited the original target and the alternate for the same item.

Reliabilities. Interobserver reliabilities were determined on 20 subjects, 8 subjects each at 18 and 36 months and 4 at 24 months. These subjects were all in the television condition which freed the research assistant typically performing as the live model to score the subject

from a television monitor in the equipment room simultaneously with the principal coder who viewed the subject through a one-way window. The reliability subjects were approximately evenly distributed according to sex and the instruction/noninstruction condition. All timing was performed on Cramer electric timers.

The two coders agreed 87% of the time on whether the subject saw a complete modeling of the target behavior or not. This was regarded as extraordinarily high, considering that the principal coder had an unobstructed view both of the subject as well as the television on which the modeling occurred while the secondary coder had to infer the direction of looking as well as its timing with the modeled sequence from a televised picture of the S. Therefore, we have confidence in the ability of the primary coder (whose data are reported here) to accurately determine whether the child saw an entire modeling sequence.

The principal dependent variable was the imitation score assessed during the imitation phase and the deferred play session. These reliabilities were .92, and .91, respectively. The time spent playing with each toy in the play session had a reliability of .99. These correlations are median figures for the distribution of comparable correlations calculated separately for each of the eight toys.

Observing the Model

Analyses in this and subsequent phases were conducted with the following rationale. An Age x Model (Live, TV) x Instruction (Instruc-

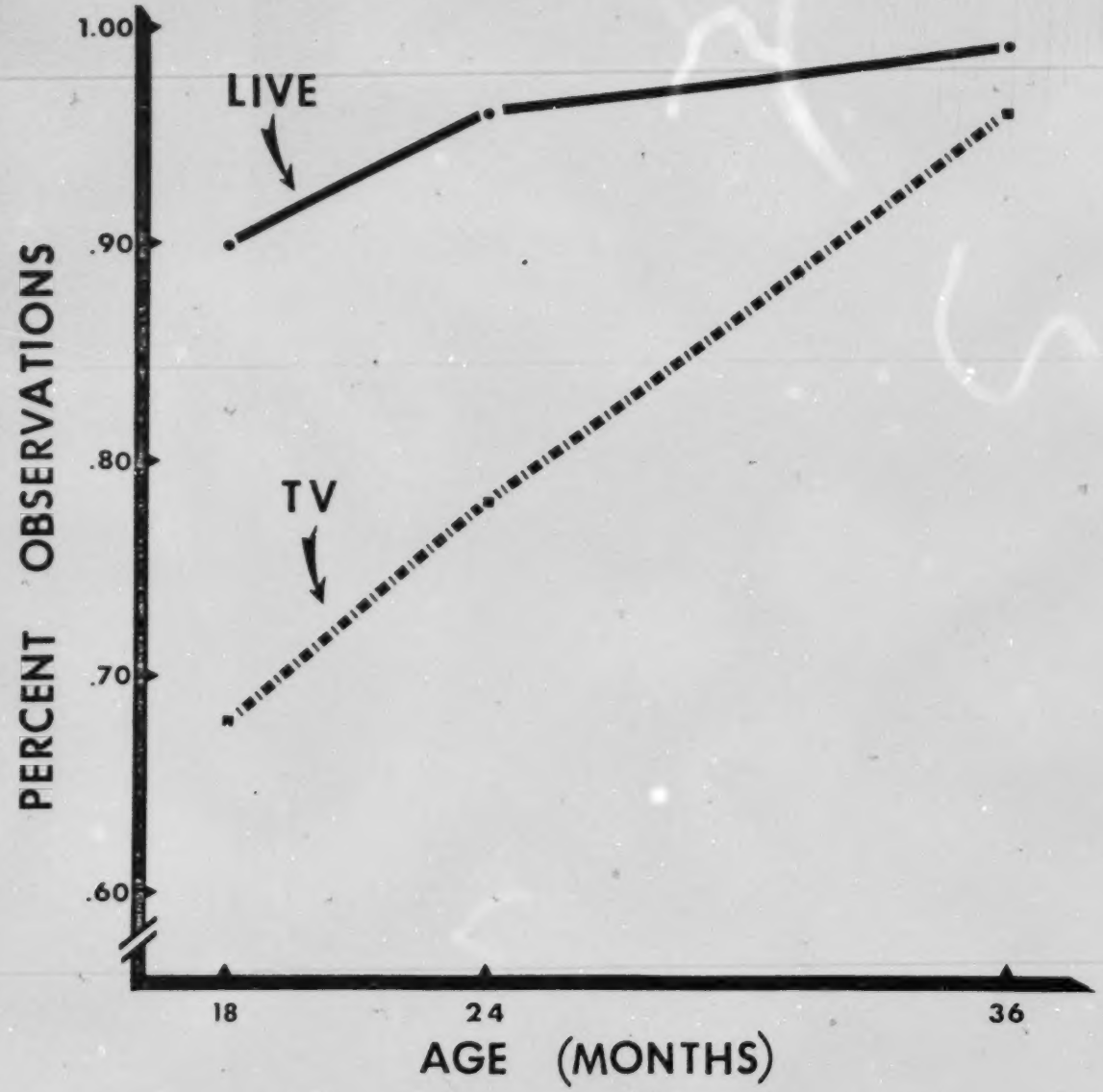
1.00
.90
.80
.70
.60
LIVE
TV
PERCENT OBSERVATIONS
18
24
36
AGE (MONTHS)

Figure 10

ted/Not Instructed) analysis was performed initially because it embodied the three principal independent variables of the study. Rather than conduct a 5-way analysis of variance by adding the control variables of sex and order of presentation with only two subjects per cell, the significant effects from the primary analysis were evaluated with respect to the control variables in separate analyses to determine if they were qualified by interactions with sex, item order, toy set, etc.

Because of technical limitations, we could not ensure that a subject completely viewed every modeling as in the previous experiment. Therefore, whether or not a subject viewed the model became a dependent variable. An Age x Model x Instruction ANOVA on looking at the model did not yield an effect for Instruction. Therefore, being told to imitate did not increase the likelihood a subject watched the model. In contrast, effects were observed for Age, $F(2,84) = 10.93$, $p < .001$, Model, $F(1,84) = 18.84$, $p < .001$, and the Age x Model interaction, $F(2,84) = 3.62$, $p = .031$. The latter result is presented in Figure 10.

Insert Figure 10 about here

Older subjects and those who saw a live model were more likely to look at the complete presentation of a target behavior, but the difference between live and TV models decreased with age until the rates were nearly identical at 36 months. Additional analyses revealed a Sex x Model interaction, $F(1,58) = 5.58$, $p < .02$, in which males and females were identical in observing a live model, but the males were generally more atten-

tive (87% versus 72%) to the televised model than were the girls. In addition, there were significant interactions between Model and Age x Model with the Order of Presentation, indicating that if interesting behaviors were displayed early in the session, subjects were more likely to continue viewing.

These data revealed that 18- and 24-month infants are one-third more likely to observe a live model than a televised version of the same person and behavior. However, by age 3, 96% of the items included in our study were watched completely when presented on television. Moreover, the difference between a live and a television model across all ages was not very great for male subjects; it was predominantly the females who were less likely to watch televised models. Therefore, a major practical issue for the television presentation of material to infants two years of age or younger is to capture their attention. However, the behaviors modeled in the present study were hardly as salient to infants as the emotional outbursts on game shows, the drama and action of cartoons, or the discrepant characters of Big Bird, Oscar, and the Cookie Monster. Therefore, we believe the attention of infants under two years of age can probably be recruited by appropriate materials.

The data also had procedural implications for subsequent data analyses. Obviously a child cannot imitate a behavior that was not seen. Consequently, all further analyses were based on dependent variables taken as an average of the number of modeled sequences each subject viewed completely. Therefore, subsequent results reflect the

likelihood of imitation given that a model was seen.

Imitation Phase

The 4-level measure of imitation was subjected to an Age x Model x Instruction analysis of variance which yielded an effect for Model, $F(1,84) = 6.78$, $p = .011$, and a borderline effect for Age, $F(2,84) = 2.83$, $p = .065$. As seen in Figure 11 imitation increased with age and was con-

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Insert Figure 11 about here

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sistently higher in the live versus the television condition. While the Age x Model interaction was not significant, the spread between the live and televised models at 36 months was one-third the analogous difference at 18 and 24 months, suggesting that live and televised models might be equivalent in promoting imitation by 42 or 48 months of age. The reader is reminded that these data are restricted to those items on which the subject saw the model; therefore, when these data are combined with those on the likelihood of observing the model, the difference between live and televised models will be accentuated at the younger ages.

There were no effects for instruction, sex, or order of item presentation.

In summary, infants 18 and 24 months of age watched and imitated a televised model, but they did so less frequently and/or less precisely than a live model. However, by three years of age, infants paid attention to and imitated a televised model almost as well as a live adult. Therefore, we speculate that by 3 to 4 years of age there may be no

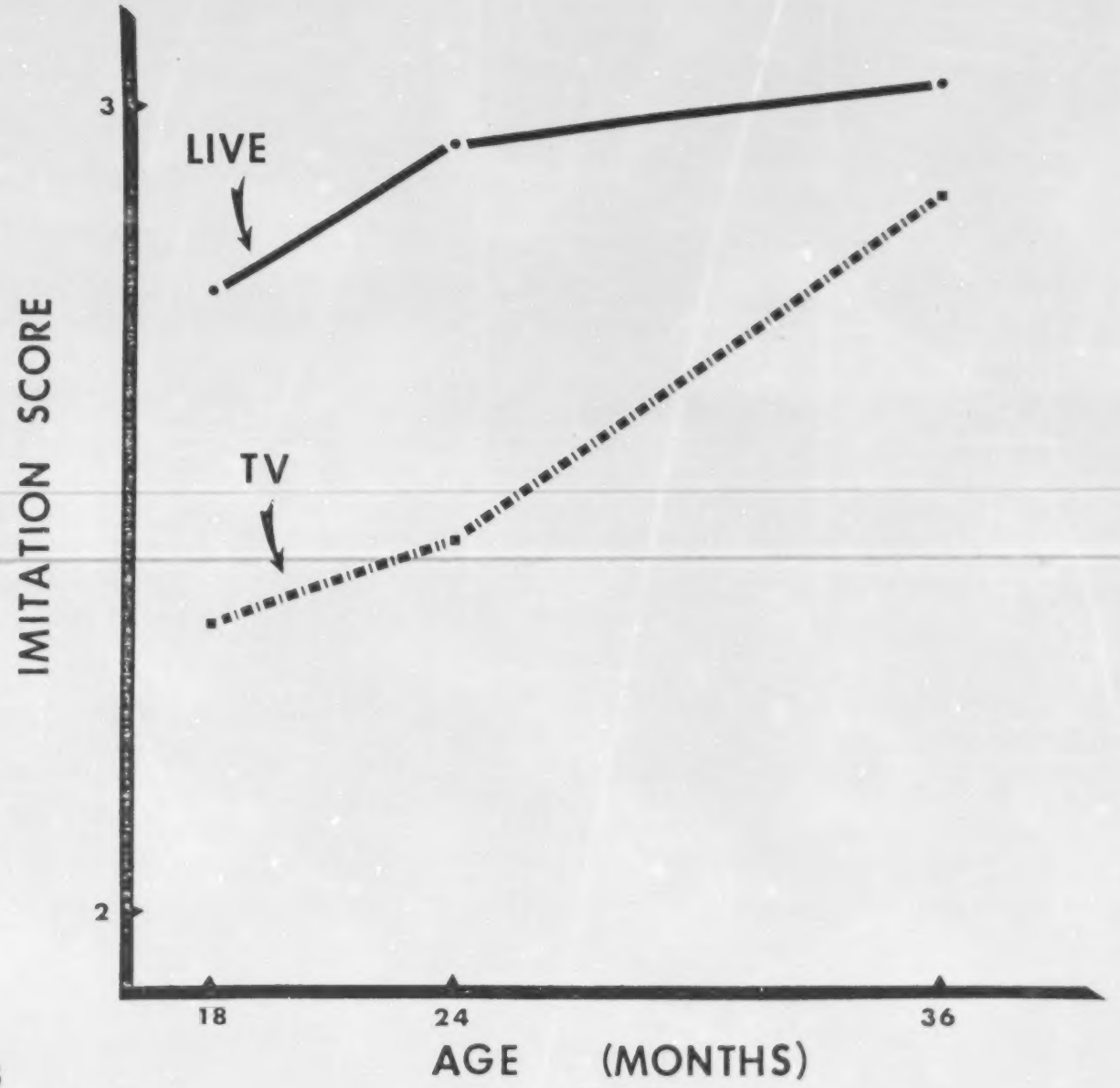

Figure 11

difference in the propensity of children to observe and imitate a televised versus a live individual, although we hasten to add that the nature of the material being presented, especially its interest value and relevance to the child's behavior, will undoubtedly modulate these behaviors.

Deferred Imitation in Play

Time spent with the toys. Although there were no control objects in the play session that were not modeled for the infant, it was nevertheless of interest to know whether children would spend different amounts of time with the toys as a function of their age, the type of modeling, and the instruction to imitate. The results of such analyses of variance conducted either over all eight toys or only on those toys for which the subject saw a complete modeling were essentially identical. Given that the subject saw an item modeled, there was an Age x Model effect, $F(2,84) = 3.89$, $p = .024$, and an Age effect, $F(2,84) = 9.28$, $p < .001$. There were no effects for sex, instruction, or order.

The results are presented in Figure 12 for the time spent playing

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Insert Figure 12 about here

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but only with objects which the infant saw modeled. While there is a tendency to spend more of the 10 minutes in play with the toys with increasing age, more time is spent with the toys after a live than a televised modeling of the object at 18 months, whereas substantially the reverse is true at 36 months. Thus, for a 3-year-old, having seen

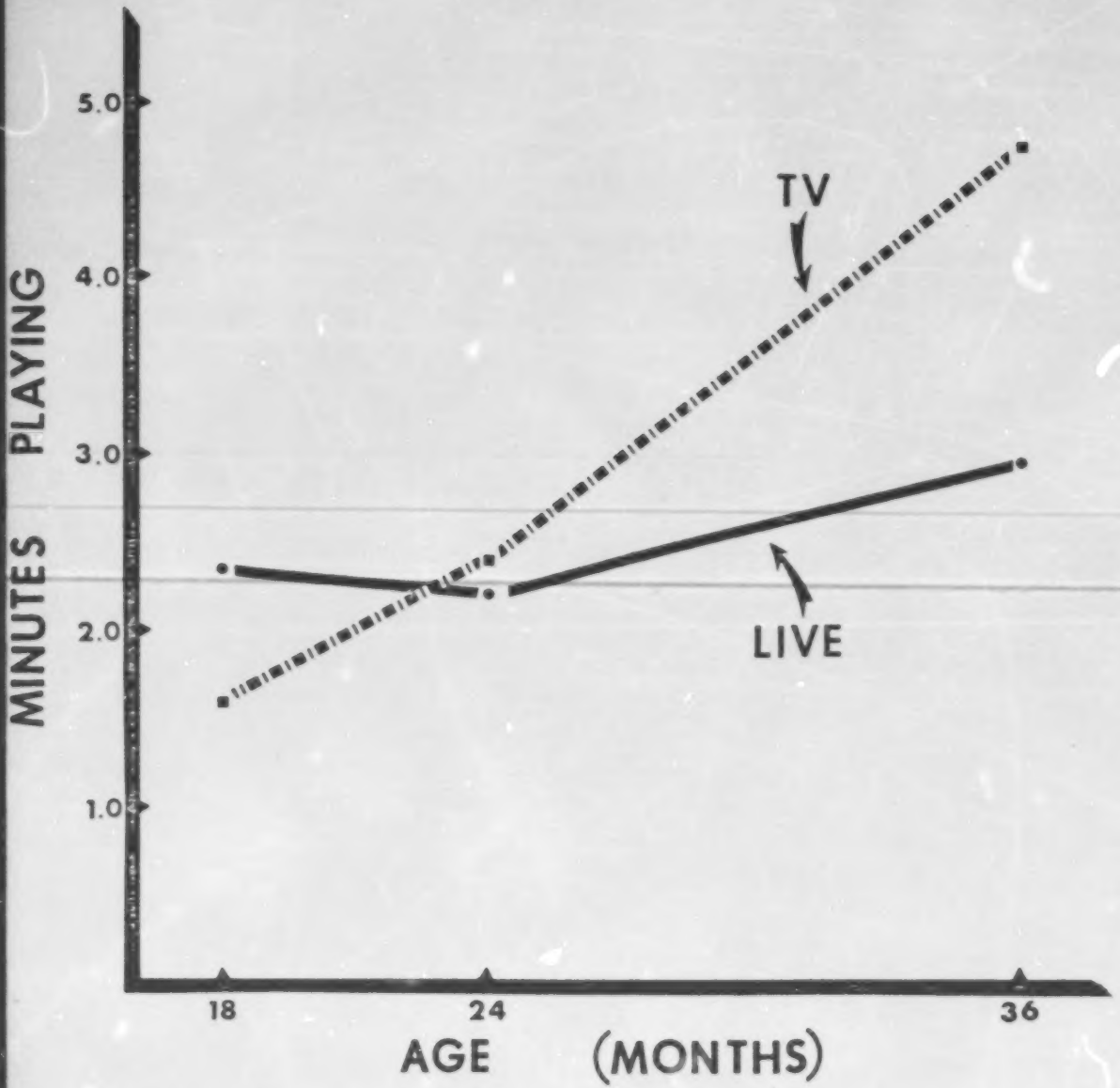

Figure 12

a toy demonstrated on television is associated with spending a longer time playing with that object than if the same toy were similarly demonstrated by the same person but in a live condition. It should be noted that there was essentially no difference between the average time spent with toys which the subject saw modeled either live or on television versus those objects which the child did not see completely modeled (except at 18 months for the television condition in which there appeared to be a novelty effect for toys not seen on television). Therefore, the effects for live versus television modeling appear to be pertinent to the modeling circumstance in general and not to differential rates of viewing the models.

Imitation. Age x Model x Instruction analyses were performed on the average imitation score during the deferred play session for items which the subject saw modeled completely. There were no effects for live versus television modeling. That is, the likelihood of an imitation during the deferred play session was not different as a function of whether the modeling was presented live or on television. Neither were there effects for sex nor order of item presentation. However, there was a tendency for more imitation to occur with age, $F(2,84) = 26.56$, $p < .001$, and the Age x Instruction interaction was also significant, $F(2,84)) = 6.57$, $p < .002$.

The latter effect is graphed in Figure 13. There was a slight

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Insert Figure 13 about here

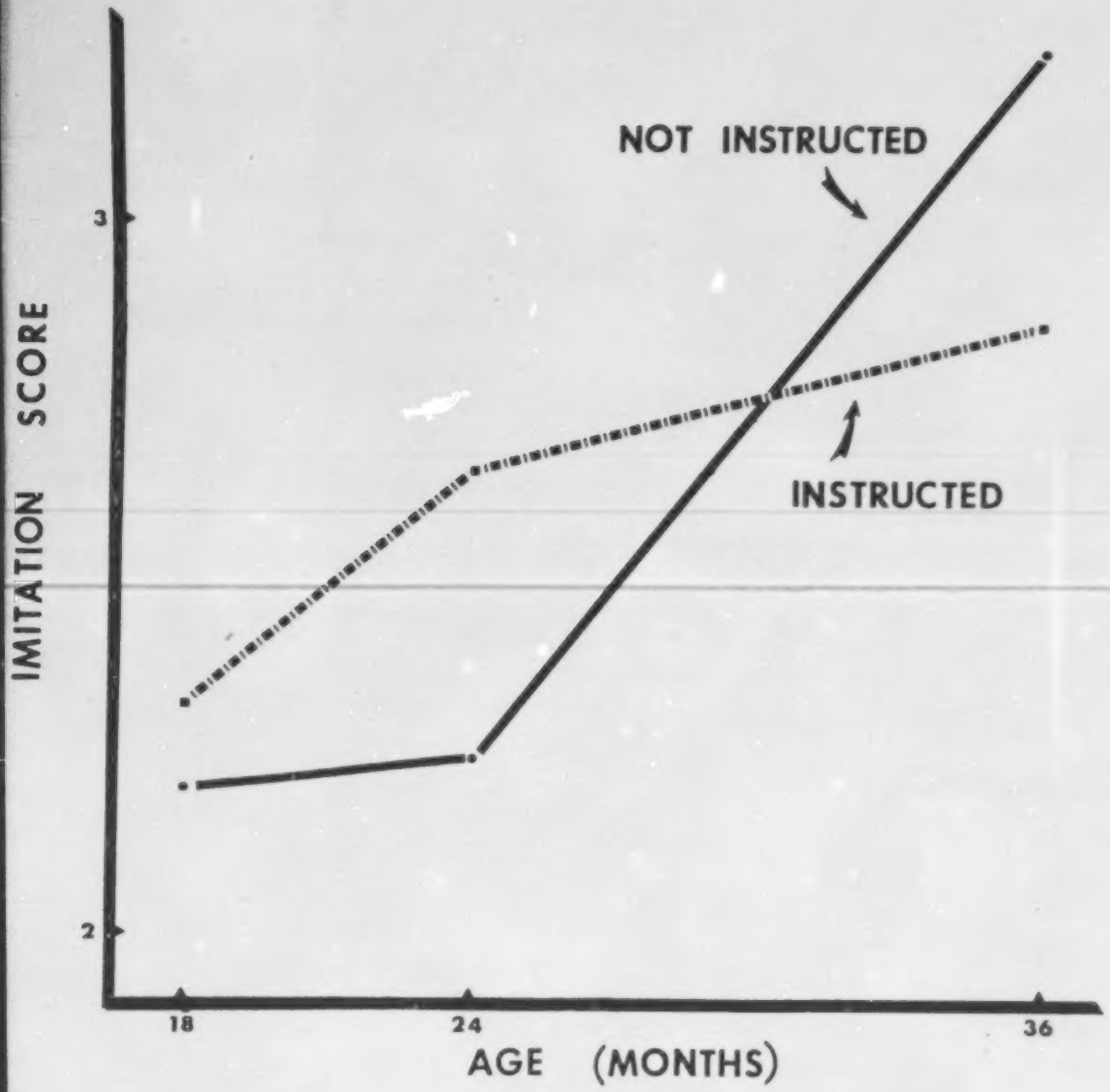
NOT INSTRUCTED
INSTRUCTED
IMITATION SCORE
3
2
18
24
36
AGE (MONTHS)

Figure 13

tendency for 18- and 24-month instructed subjects to imitate more than noninstructed subjects during the deferred play session. However, 3-year-olds who were not instructed to imitate actually imitated more than those instructed to do so. Perhaps the most interesting aspect of this result is the failure to find an effect for instruction when imitation was assessed immediately and in the presence of the model who gave the instructions but to find an effect later in play when the instructor was not present. Ironically, however, instructing a 3-year-old to imitate does not produce more deferred imitation and may even lead to less than not so instructing the child.

Original versus transformed toys. Recall that half the toys in the play session were identical to the objects modeled for the child while half the toys were form and color transformations of the originally modeled toys. The expectancy was that the transformations would increase interest in the objects yet provoke some degree of uncertainty about what to do with them. Therefore, more time should be spent with the transformed than the original objects and perhaps more imitation as well. Consequently, an Age x Model x Instruction x Original/Transformed Toys was performed on the time spent playing and the imitation score averaged over the four original and over the four transformed toys.

In general, our predictions were not borne out. Specifically, with respect to the time spent playing with the objects, there was no effect at all for live versus TV model or any interactions with

it. However, there was an Age x Instruction x Original/Transformed Toy interaction, both in the analysis ignoring the looking behavior during modeling, $F(2,84) = 4.94$, $p < .009$, as well as in the analysis restricted to those items which the subject had seen modeled completely, $F(2,84) = 4.95$, $p < .009$. This result indicated that children at 18 months played longer with the transformed toys than with the originals. However, by 36 months, infants instructed to imitate were playing essentially the same length of time with the original as with the transformed objects, whereas those children not instructed spent a substantially longer period of time playing with the transformed toys than with the originals.

With respect to the imitation score, there was a Model x Original/Transformed Toy interaction as well as an Age x Original/Transformed Toy interaction when the response to all toys was considered, regardless of looking at the model. But neither of these effects were significant when the analysis was restricted to those objects which the infant had seen modeled completely. Therefore, while transforming the object slightly from those modeled for the infant increased the amount of time the child spent with the toy (with some exceptions), it did not alter the likelihood of an imitation in deferred play.

Home Television Habits, Temperament, and Imitation

TV questionnaire. Parents were asked how much time their children spent watching television on a typical day as well as the specific

Table 14. Percent Parents Reporting Their Child's Most Watched TV Program

Type of Program	Age (Mos.) 18	24	36	Total
Children's educational shows	41	61	64	55
Commercials	18	05	07	10
Action shows	10	09	04	08
Family drama	02	02	11	05
Miscellaneous	24	14	07	15
No preference	04	09	09	07

programs that they watched most. The reported amount of viewing time per day increased with age, averaging approximately 41 minutes at 18 months, 65 minutes at 24 months, and 115 minutes at 36 months.

Table 14 gives the percentage indicating which types of programs

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Insert Table 14 about here

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their children watched most. These data represent a parent's first response to the question, "What are the television programs that your child watches most frequently?" Moreover, the results are based on 139 subjects (51, 44, and 44 at 18, 24, and 36 months, respectively), including the subjects who did not contribute imitation data. No major sex differences occurred, but 24-month children who had older siblings were more likley than those without siblings to list a children's program as their most watched show (76% versus 48%), although this difference was not present at 18 or 36 months.

Table 14 indicates that more than half of the sample watched a children's educational program most regularly, especially Captain Kangaroo, Sesame Street, and Uncle Al (Cincinnati). Interestingly, less than 4% of the total sample listed cartoons as their most watched show--in fact, commercials were named more frequently than cartoons, despite the wording of the question which requested television "programs." Although the percentages were insignificant at 18 and 24 months, one out of ten 3-year-olds most watched a family drama program (e.g., The Waltons, Apple's Way, The Partridge Family, etc.). The miscellaneous category included game shows, programs on animals, musical and variety programs, and talk shows. The develop-

Table 15. Factor Loadings for Temperament Questionnaire

Item Number (Table 12)	Description	Factors 1	2	3	4	5	6	7
16	Draws close to one showing affection or approval	86						
35	Attends to person attempting reciprocal socialization	77						
2	Readily responds with smile to friendly person	74						
9	Shows warm, friendly disposition to person attempting to please S	68						
17	Attracted to and examines objects and materials in environment	50						
10	Likes to feel, smell, taste, pound, squeeze and examine new toys	42						54
13	Fearful of handling strange objects; needs time before touching	-66						
6	Shies away from anything strange and different	-53						
8	Talkative, expresses self through language on every occasion		85					
15	Talks or babbles to you when you come near or pay attention		85					
29	Uses vocalizations, not gestures or facial expressions, to express desires		67					
22	Readily talks or vocalizes following encouragement		62					
1	Talks or babbles to you about toys, clothes, or current activity		61					
23	Readily shows you current project being made or played with		58					
31	Points inquiringly to objects; asks questions if able		43					57
18	Switches from one activity to another frequently			-84				

Table 15 (Continued)

Item Number (Table 12)	Description	Factors						
		1	2	3	4	5	6	7
4	Easily loses interest in activities once started; goes from one thing to another			-84				
11	Goes rather quickly from one object or activity to another			-83				
32	Rarely maintains interest in a game or activity for long			-68		-45		
25	Seems to forget current activity; goes to something else at slightest distraction			-54		-45		
27	Afraid to get near moving toys, noisy toys, balloons or unusual objects				67			
33	Gets absorbed in task; hardly notices outside activities and distractions				55			
34	Afraid to engage in activities using equipment like slides, swings, rides				51			
26	Able to focus attention for considerable time on something being attempted					82		
19	Good at directing attention and interest toward single object					78		
12	Gives long attention to objects, toys or books of interest to S					72		
5	Centers attention on current activity; not easily distracted					42		
14	Readily looks to you when you call to S or call S's name						89	
21	Responds readily when effort is made to get S's attention						73	
7	Watches and follows what you are doing when shown how toy works							81

Table 15 (Continued

Item Number (Table 12)	Description	Factors 1	2	3	4	5	6	7
3	Tries toys out in many different ways; curious as to what S can get them to do							64
24	Tracks down noises, voices and activities to see what is going on							54
30	Enjoys being played with							44

mental trend in the data is toward a more focused selection of programs by 3 years of age, principally concentrating on children's educational and family drama programs.

The relationship between the amount of television viewing and imitative behavior will be discussed in the next section.

Child temperament questionnaire. Parental responses to the 35-item temperament questionnaire were factored with a principal components analysis plus Varimax rotation for the sample of 95 completed questionnaires. A total of seven factors were interpretable, and the item loadings for these factors are given in Table 15. While our intent was not

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Insert Table 15 about here

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to infer broad dimensions of personality and social behavior from these data, it will be convenient to label these factors for later reference. Factor 1 reflects an extraversion and a willingness to approach people and new objects, Factor 2 represents a talkative youngster, Factor 3 indicates persistence (note negative loadings), Factor 4 signified a shyness with imposing toys, Factor 5 describes attentiveness, Factor 6 indicates a child who is attentive when called, and Factor 7 depicts curiosity with objects.

Correlations with imitation. The problems associated with determining correlations within a sample composed of subjects from different classifications have been discussed above. In this particular case, one might suppose that relationships between parental reports of child

temperament or TV watching and imitation would be different for live versus televised models and might change across age. Unfortunately, there were simply not sufficient numbers of subjects to calculate correlations separately within each age and model condition. Therefore, a compromise strategy was adopted in which correlations were calculated separately for live and TV model conditions within the Instruction x Age cells but pooled over Instruction and 18- and 24-month cells separately from the Instruction and 24- and 36-month cells. Therefore, the correlations for the younger and older subjects are not independent, because both groups include the 24-month sample.

Table 16 presents these within-cell correlations relating child

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Insert Table 16 about here

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temperament ratings and biographic information including hours watching television with imitation during the imitation assessment phase and during the deferred play period. Overall, the correlations are modest in size and only 6 of 112 nonindependent correlations were statistically significant. However, the pattern of relationships was not totally random. For example, 18- to 24-month children who were reported to be shy with imposing toys did not imitate as much as children who were reported to be assertive in such situations. In addition, 18- to 24-month youngsters who were described by their parents as attentive when called and attentive to objects tended to show more imitation of the live model than infants not described as attentive. The relation-

Table 16. Within-Cell Correlations (Within Ages and Instruction Conditions) for Child Ratings and Biographical Information with Imitation as a Function of Age and Model

	Immediate Imitation Phase				Deferred Imitation			
	Live Model		TV Model		Live Model		TV Model	
Child Temperament Ratings	18-24	24-36	18-24	24-36	18-24	24-36	18-24	24-36
Extraversion	28	19	11	34	-06	11	03	-01
Talkative	24	44*	-03	-22	19	37	26	13
Persistence	-06	13	-05	-11	14	13	19	31
Shy with imposing toys	-43*	-04	-35	-06	-33	-11	-33	-13
Attentiveness	19	05	-01	28	38*	04	-36	13
Attentive when called	26	-20	-08	-19	43*	-03	-10	-04
Curious	-10	-11	-33	-17	-01	30	14	-36
Biographic								
Hours watching TV	11	15	07	22	31	38*	15	24
Siblings 0-3 yrs. older	31	14	10	-03	03	-13	12	33
3-6 yrs. older	-22	05	09	24	-35	16	-09	06
6+ yrs. older	15	-34	15	34	32	-13	13	21
Mother's education	07	-01	27	48**	04	-24	19	-01
Father's education	08	17	-27	-12	07	-02	10	-04
Midparent education	08	13	-25	-04	06	-12	18	-07

* $p < .05$

** $p < .01$

ship did not hold for the television model. Finally, 24- to 36-month children reported to be talkative displayed relatively more imitation of the live model, but there was no consistent relationship for the televised model. In short, there is a possible tendency for toddlers who are described by their parents as being not shy with imposing toys, attentive to objects and attentive when called, and talkative to show relatively more imitation, especially of a live model (although there may be developmental changes in the level of these relationships). There were no significant correlations with imitation in the TV modeling condition, although there was a tendency for children who were not shy with imposing toys and objects to imitate the televised model more frequently.

There was a slight tendency for children who reportedly watched more TV to imitate observed behaviors when in the deferred play condition, more, although the relationships were not totally consistent. There were no consistent relationships for the presence or absence of siblings, but the analyses could not be broken down according to the sex of the infant subject, a factor found salient in the Fels data. Parental education similarly did not show strong or consistent relationships, although the highest correlation obtained was between mother's education and imitation of the TV model at 24-36 months.

In sum, the individual difference relationships were infrequent and of modest size. However, there tended to be moderate correlations between children who were socially extraverted, attentive, talkative, and not shy with imposing toys and a tendency to imitate live (but not necessarily televised) models.

Experiment 4: Deferred Imitation of a Televised Model in the Play of Two-Year-Olds

Deferred imitation has special salience conceptually as well as practically. Piaget (1951) emphasized that deferred imitation was a sign that the child had acquired certain symbolic abilities, because its manifestation required the encoding, memory, and retrieval of symbolic material. From a practical standpoint, it is typically not appropriate or functional for a child to imitate an event portrayed on home television at the time of viewing. Rather, most imitation of home television is likely to be deferred.

The previous studies contained only partial assessments of deferred imitation. That is, deferred imitation was examined only after a test for imitation immediately following modeling had transpired. Because infants had a chance to practice the modeled behavior during immediate imitation, this was not a pure test of deferred imitation. "Imitation" in the deferred phase might have been a simple repetition of a previously executed act reinforced by its own perceptual consequences and not strictly imitation at all.

A second limitation of the previous studies was the fact that the time interval between observing the model and the deferred phase was relatively short--not longer than 30 minutes and as short as 1-2 minutes for some items. Therefore, the present study was directed at providing a pure assessment of deferred imitation using intervals of up to one day.

We have been somewhat disappointed at the level of imitation displayed by our subjects and concerned about our subjective impression that they often appeared bored or quickly satiated with an object. We suspect this derives from items and procedures selected for their experimental rigor and not with the needs of the child or the naturalistic environment in mind. Therefore, we felt it was time to institute more ecologically valid procedures and maximize the likelihood that imitation should occur. Consequently, in the present study, we used two-year-old subjects (at the threshold of deferred imitation) who viewed other two-year-olds of the same sex displaying (without interruption) four consecutive specific acts with different toys. Then, the subjects were allowed to play with eight toys, four of which were identical to those displayed on television while the other four were novel to the child in this context. Moreover, we relied more on commercially available toys than specially constructed items. We felt these procedures produced a more ecologically valid experimental replica of home television viewing, and we presumed they would increase the likelihood of imitation.

Method

Subjects

Subjects were selected by the same procedures described for Experiment 2. The 48 subjects averaged 111.8 weeks (approximately 26 months) with a standard deviation of 4.03 weeks. The sample consisted of 43 white, 3 black, and 2 oriental children with good health

histories (except 1) and parents who averaged 1-2 years of college. The subjects were evenly divisible by sex and were assigned in equal numbers to the major experimental conditions. Four additional subjects were seen but not used, two because of experimenter error and two because they failed to watch at least three of the four modeling episodes (see below).

Materials and Procedure

Materials. The materials used in the modeling sequence are presented in Figure 14, and the target behaviors are detailed in Table 17

Insert Figure 14 and Table 17 about here

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which also includes the definition of a perfect and an approximate imitation. All toys with the exception of the Whacker and Car and Slideare commercially available.

The eight objects and target behaviors were divided into two sets of four. Set 1 included the Doll and Tea Set, Big Mouth Singers, Knocky, and Car and Slide, whereas Set 2 was composed of the Broom-Dustpan-Basket, Large Building Blocks, Busy Driver, and Whacker. Four adults rated the eight objects with respect to their sex-appropriateness, potential for producing perceptual consequences, potential for imaginary or thematic play, and age-appropriateness. The two sets represented approximate equivalents with respect to these ratings. Unhappily, as we shall see, Set 1 was considerably more popular with our two-year-olds than was Set 2.

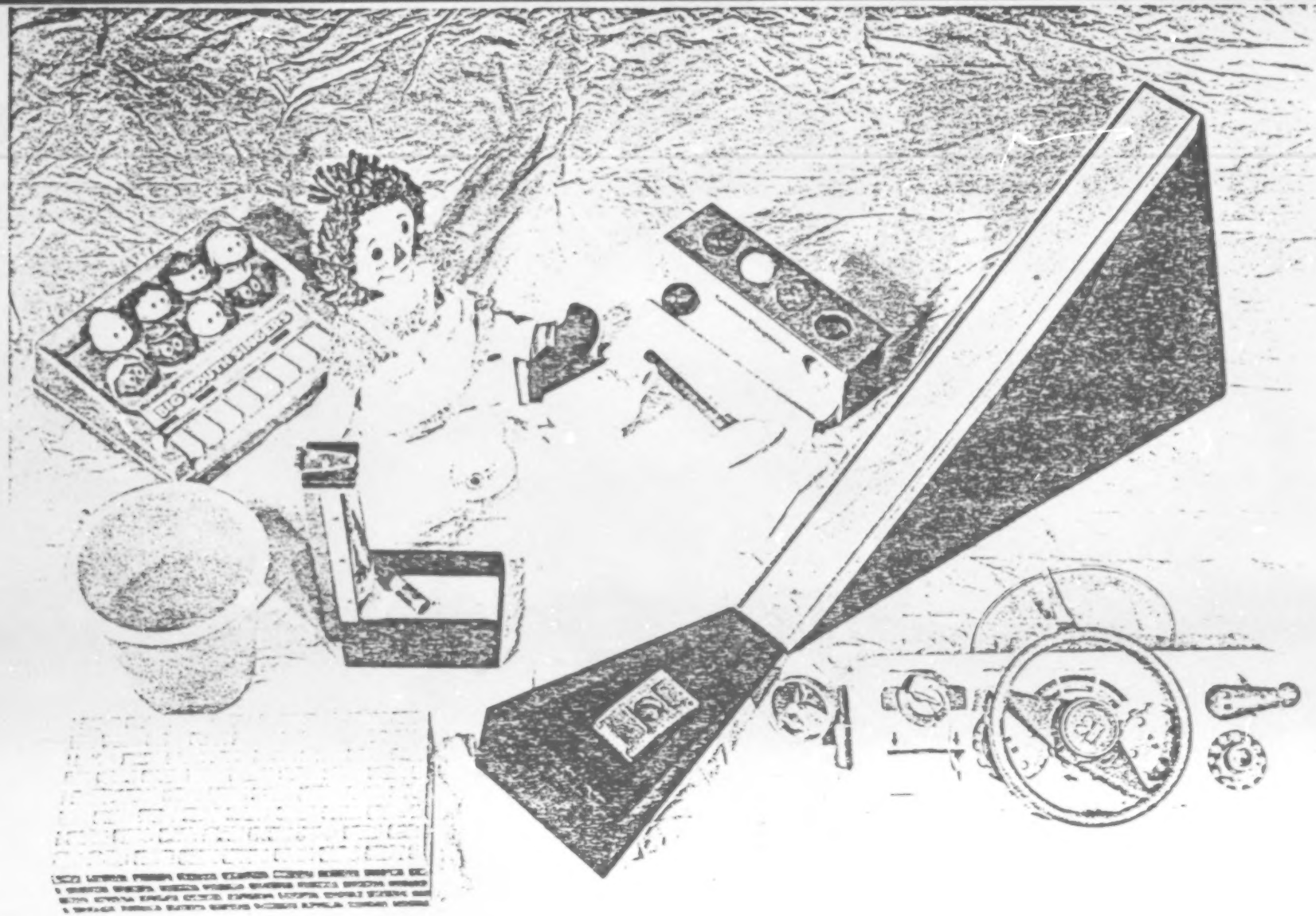

Figure 14

Table 17. Target Behaviors Modeled in Experiment 4

Doll & Tea Set

Target: M pours something into cup from teapot; gives doll a drink.

Approximation: Gives doll a drink without pouring into cup or pours into cup without giving doll a drink.

Big Mouth Singers

Target: M pushes starting button and simultaneously depresses 2 keys to make a noise.

Approximation: Pushes down keys without turning on starting button or turns on starting button but does not play keys simultaneously.

Knocky

Target: M hits balls with hammer, knocking one ball (not necessarily for ball to go through). (Credit also given if S pushes ball through with hands.)

Approximation: Hits at balls with hammer but not when they are located in their stand, hits stand with hammer without balls, or pounds balls or stand with hand.

Car & Slide

Target: M puts two incline planes together so that they make a long hill for the car to go down and a short hill for it to go up. M puts car at top of slide and lets it go (or rides it down with hand) so that car travels down long incline and up the shorter one.

Approximation: Rides or pushes car down (or up) only one incline or puts two inclines together but fails to push or ride car down.

Table 17 (continued)

Broom, Dustpan, Basket

Target: M holds dustpan in one hand, broom in other hand, and sweeps with broom so that it looks like dirt is going into dust pan; then M empties imaginary dirt into basket. (Credit for imitation also given if S puts pan on floor and sweeps into it followed by dumping dirt into basket.)

Approximation: Sweeps onto dust pan, but does not put dirt into basket or empties dirt into waste basket without sweeping.

Large Building Blocks

Target: M piles at least 3 of 4 blocks so that they are stacked to make a tower, then M kicks or pushes it over.

Approximation: Stacks any 2 blocks and kicks or pushes them over or stacks 3 or 4 blocks but does not kick or push them over.

Busy Driver

Target: M pulls key out, puts into ignition, and turns once.

Approximation: Pulls key out and puts key into ignition but does not turn.

Wacker

Target: M puts wooden pellet into top of trough and then hits yellow board with hammer or hand causing the wooden pellet to fly upward.

Approximation: Hits yellow board with hammer without putting pellet into trough or puts pellet into trough without hitting yellow board with hammer.

Four two-year-olds (2 males and 2 females) were recruited in addition to the sample of subjects to perform the target behaviors for videotape recording. Each of the four models provided usable footage for both sets of toys, but the order of the four toys was confounded with particular model. Therefore, the control factors of model and toy set, which were not of particular conceptual interest, were themselves not perfectly balanced; however, these control factors as an unbalanced set were perfectly crossed with the major independent variables.

Procedure. The observations were conducted in a large mobile laboratory located at shopping centers in the Springfield and Dayton, Ohio, area. After the general nature of the observation was explained, biography information gathered, and written informed consent obtained, the child and parent were asked by the E to sit in front of a wall-mounted television which was then uncovered by the E. The S was told that another child of their sex (sex of model and sex of subject were confounded and not experimentally manipulated) was going to play with toys on the television. When the S was oriented at the screen, the modeling sequence was played. An observer watched the S to determine if the S attended to each of the four modeling episodes sufficiently to be able to grasp what the model did with the toys. Each of the four target behaviors was modeled only once; and the four modeling episodes were presented without interruption, regardless of the subject's viewing behavior.

After the television modeling was complete, the TV screen was covered. In the no delay condition, the eight toys (four of which were identical to the modeled stimuli while four were new to the subject) were placed alternately in a circle on the floor in one of two orders which varied the distance of each particular toy from the mother's chair, and the play session began. For the delay condition, the session terminated after the modeling episode. Parents were asked to put away toys at home that resembled those appearing in the modeling sequence until the child returned the next day at approximately the same time for a play session. Both delay and nondelay subjects were given a 15-minute play session with the eight toys.

Dependent variables. The E conducting the session sat with the S during the television modeling sequence and noted whether or not the S saw enough of each television modeling episode to be able to reproduce the behavior. All subjects saw at least three of the four episodes, but the data to be reported are averaged over the number of episodes the S actually did see. When the play session started, a timer lit up a small jewel light every 10 seconds during which the coder indicated what toy had been played with, what appropriate behaviors were displayed, and whether an approximation or a perfect imitation occurred during that interval. From such a record it was possible to subsequently obtain the sequence in which the toys were contacted, the length of time spent with each toy, the number and kinds of appropriate behaviors displayed, a creativity score, and the level

of imitation (none, approximation, and perfect imitation) for each object.

Appropriate behaviors and the creativity index were defined as in previous research (McCall, 1974). An appropriate behavior was an action uniquely tailored to a specific object that would not be expected to occur with other toys and that usually involved some thematic content. The possible appropriate behaviors for each object were listed before the subjects were seen. The creativity index was the number of each appropriate behavior multiplied by an inverse ranking of its frequency in the total sample (Rank 1 was given to the most frequent behavior) and summed over all such behaviors within a subject. This yielded an index of the extent to which the child displayed appropriate but unique behaviors with the objects. The variables described above have all been recorded reliably on previous occasions reported in this monograph or elsewhere (McCall, 1974).

The purpose of these diverse measures was to determine more specifically than simply imitation/no imitation the effects of seeing an object modeled or played with on television. For example, it was possible for children not to imitate but to play with such objects before contacting nonmodeled toys and to play with them in qualitatively different ways or for different lengths of time. In fact, modeled toys may have lost some of their uncertainty and be played with for shorter periods of time and with less creativity and appropriate behaviors than nonmodeled objects. Conversely, the modeling

sequence may attract attention to these objects and produce greater levels of these activities.

Results

The basic analysis was a Sex x Toy Set x Delay (Immediate, 1-day) x Modeled/Nonmodeled Toys. The dependent variables were averaged across the four nonmodeled toys and across those toys for which the subject saw the model perform the target behavior.

Preliminary Analyses

Although attempts were made to develop two sets of four toys that were relatively equivalent in appropriateness and interest value, this did not turn out to be the case. The toys in Set 1 (Loud Mouth Singers, Knocky, Tea Set, Car and Slide) were considerably more interesting to these two-year-olds than were the toys in Set 2 (Busy Driver, Large Building Blocks, Whacker, Broom-Dustpan-Basket). Set 1 toys were contacted sooner in the play session, $F(1,40) = 7.45$, $p < .01$, and played with almost twice as long as toys in Set 2, $F(1,40) = 32.97$, $p < .001$. This effect was attributable to the attractiveness of the Big Mouth Singers and the Knocky, both of which were in Set 1. However, the Busy Driver, a member of Set 2, elicited several times more appropriate behaviors, $F(1,40) = 39.62$, $p < .001$, and the highest creativity index, $F(1,40) = 32.59$, $p < .001$ (statistics for Set 2 versus Set 1 comparisons). However, a careful examination of the pattern of results reported below indicated that the effects for modeling were not qualified by these toy differences when the Model/No Model effect was examined within a toy

set (between subjects).

Effects of Televised Models

Imitation. The imitation score (none, approximation, perfect imitation) revealed that modeled toys were imitated almost 60% more frequently and/or accurately than nonmodeled toys, $F(1,40 = 6.98$, $p < .02)$. The effect is graphed in Figure 15 in which the imitation score per item is plotted

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Insert Figure 15 about here

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as a function of modeled/nonmodeled toy sets and as a function of delay/no delay. Note that the scores for the modeled condition are taken as an average over only those toys which the subject actually saw modeled.

Although the graph indicates a rise in the level of performance after a delay, this was not statistically significant, $F(1,40) = 1.92$ (4.08 is required at $p < .05$), and there was no Model/Nonmodel x Immediate/Delay interaction, $F < 1$. Even if the main effect for Immediate/Delay had been significant, one should observe that the level of target behaviors increased almost as much for the nonmodeled as for the modeled toys, implying that there was simply a higher rate of spontaneous displays of the target behaviors after a delay. This may indicate that seeing toys played with on TV actually suppresses play temporarily but recovery occurs after a delay of one day. In any event, subjects clearly displayed imitation of the televised two-year-old model, the extent of this imitation was not impeded by a 1-day delay between modeling and play, and there were no qualifications on this effect associated with toy set and specific child model.

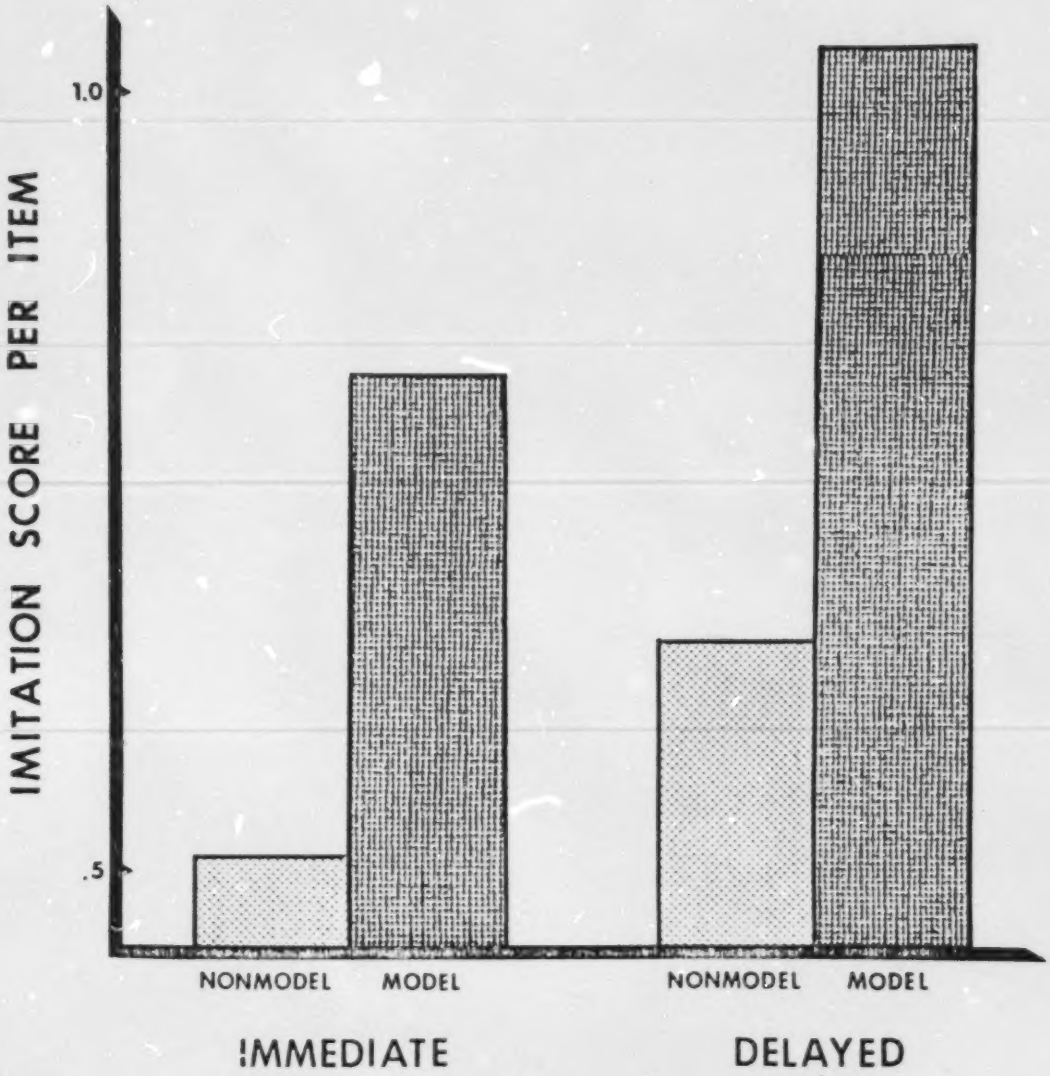
IMITATION SCORE PER ITEM
1.0
.5
NONMODEL
MODEL
NONMODEL
MODEL
IMMEDIATE
DELAYED

Figure 15

Style of play. Seeing a toy modeled on television might have other influences on a toddler's play behavior besides simple imitation. For example, such an experience might influence which toys are selected to be played with first, how long toys are played with, and the amount of appropriate and creative behavior enacted with them. Analyses on these four variables indicated that modeled toys were contacted sooner than nonmodeled toys, $F(1,40) = 4.85$, $p < .05$, and more time was spent playing with the modeled than nonmodeled toys, but males manifested this effect during the play session immediately following modeling while girls did so after a 1-day delay, $F(1,40) = 5.06$, $p < .05$. The number of appropriate behaviors and their creativity were not significantly altered as a function of televised modeling.

Conclusions

Summary of Results

Two studies involving televised models and the disposition to imitate among 18, 24, and 36-month children revealed several themes.

Live Versus Televised Model

1. Infants 18 and 24 months of age were 1/3 more likely to watch a live than a televised model, but this was almost solely attributable to female subjects. By three years of age, 96% of all items were watched and no differences in viewing behavior as a function of live versus TV modeling were detectable. However, attention to a televised model by children of almost any age will depend upon the appropriateness and interest value of the material presented; therefore, it would be presumptious to conclude that children are not prone to watch a televised model before two years of age. Rather, attention to the model is more likely a problem before two than after three years.

2. Given that a youngster watches the modeling performance and is permitted to imitate immediately after a modeling, imitation of a live model is somewhat more accurate and/or frequent than of a televised model, but this difference declines with age and is essentially absent after age three.

3. In a free play session conducted a few minutes after the imitation assessment phase, no difference between live and televised models was observed in the amount and/or precision of deferred imitation, although 18-month subjects played with the toys more after a live

modeling while 36-month children spent more time with the toys after a televised modeling experience.

4. Verbal instructions to imitate did not influence the rate and/or accuracy of imitative performance assessed in the presence of the instructor (i.e., in the live condition) immediately following modeling; but 18- and 24-month subjects imitated more during the deferred play session (instructor not present) if they were told to imitate, whereas three-year-olds imitated less if they had been previously instructed.

5. No systematic or pervasive effects were associated with the sex of subject, the presence or absence of siblings of various ages, or with parental education.

6. It was predicted that modifying the form and/or color of a modeled toy might increase interest and lead to greater time spent with the toy as well as create more uncertainty over what to do with the object which would provoke more imitation relative to toys that were identical to those presented during modeling. While the transformations created more interest, they did not elicit more imitation.

7. Parents estimated that their 18-, 24-, and 36-month children averaged 41, 65, and 115 minutes of daily television viewing, respectively. They reported that children's educational programs and (for the three-year-olds) family situation shows were "most watched." Cartoons were rarely mentioned as a favorite program--even commercials outranked them at the younger ages. Only small and inconsistent rela-

tionships between reported television viewing and deferred imitation were observed.

8. Correlations between parent ratings of temperamental characteristics of their children and imitation were modest and not consistent over age. There were weak trends indicating that children described as not shy with imposing toys, attentive to adults and play objects, and talkative imitated live models more than children whose parents rated them at the opposite ends of these dimensions. Temperamental characteristics were not related to the imitation of televised models.

Televised Modeling Versus No Modeling

9. Two-year-olds displayed the target behaviors (i.e., imitated) approximately 60% more for the modeled than for the nonmodeled acts. The modeled toys were contacted earlier in the play session and were played with longer (depending upon sex and the length of the model-performance delay).

10. A delay of one day between television modeling and the play session did not retard imitation by two-year-olds.

Implications

The television data show that even two-year-olds can and will imitate a televised model, but the likelihood of imitation depends on certain parameters. First, in contrast to older children, the attention value of the material presented on television is more critical--18- to 24-month toddlers were not as attentive to our televised events

as were three-year-olds. Moreover, even when they did observe an action on TV, they were less likely to imitate it than if that act had been performed by a live adult.

Second, we believe that all children, but especially younger ones, will imitate an act predominantly when it is appropriate to do so and when it serves a contemporary purpose. Infants may be less flexible in this regard than toddlers. Therefore, unless the material presented on television is pertinent to the naturalistic behavior of child viewers, it may have minimum effect.

However, given that the actions presented on TV are simple, captivating, and relevant to the child's naturalistic behavior, imitation is possible by two-year-olds regardless of sex, socioeconomic class, temperamental characteristics, typical variations in TV viewing habits, and the presence or absence of siblings. Moreover, a delay of one day between viewing the act and the opportunity to imitate will not inhibit the likelihood and/or precision of imitation, thereby implying that two-year-olds can defer performance over at least moderate lengths of time until such acts are appropriate to their behavioral purposes.

An interesting result occurred when subjects were instructed to imitate. The 18-month infants who were instructed were more likely to imitate in a deferred play session than noninstructed controls, presumably reflecting our suspicion that some youngsters did not always realize what "game" was to be played. However, among three-year-olds, who generally imitated quite readily, being instructed by the model to

imitate led to less deferred imitation than if no instructions had been offered. The latter finding is not unlike the recent observations on preschool children in which adult suggestions regarding which toys to play with as well as adult rewards for doing so lead to less play with such objects later in an unstructured free play episode than if the child had not been so instructed or rewarded (Greene & Lepper, 1974; Lepper, Greene, & Nisbett, 1973; Ross, 1975). The precise dynamics of this effect are still unsolved, but the emergence of independence, self-assertion, negativism, and the exploration of oneself as a dynamic force in the social environment that presumably occurs between two and three years of life (e.g., the "terrible two's") may be involved. Alternatively, the definition by an adult of what should be done with a toy may answer the question that exploratory behavior typically addresses, "What does this object do?" It may also squelch the desire of a toddler to play with the object, the purpose of which may be to resolve the issue of, "What can I do with this object" (Hutt, 1970; Weisler & McCall, 1976). The implications for television programming, preschool teachers, and parents are clear.

CHAPTER 4: THE SOCIAL SIGNIFICANCE OF BEING IMITATED

The studies described above have concentrated on outlining parameters and correlates of imitative behavior in 12- to 36-month infants. This type of enterprise characterizes the American research psychologist's primary activity. An equally important question, but one often overlooked, concerns the function a given behavior has for the organism and species (McCall, 1976-a). That is, what does a behavioral disposition or the performance of a class of behaviors contribute to the adaptation of the organism or the improvement of the quality of life?

Possible Functions of Imitation

One obvious function of imitation is that it is an efficient learning strategy. Infants can "discover" a new response by observation and note the consequences of that behavior without actually risking the action themselves. There seems little question that observational learning and imitation operate in this manner in the naturalistic development of the human organism.

Another function of imitation is its potential role in developing social cognition. For example, Mueller and Lucas (1975) described the beginning of peer-peer social relations among children in their second year of life. They observed that early social relations consist of mutual influencing and the exploration of social contingencies, and that imitation is a primary behavioral vehicle for initiating such reciprocal influencing.

Specifically, initial peer-peer social interactions have two predominant characteristics--they are physical in nature and they are secondary to the child's interest in exploring or playing with an inanimate object or portion of the environment (Mueller & Lucas, 1975). Two toddlers struggling over the same toy illustrates these dispositions. In contrast, adult social relations are performed at a distance--without touching the other individual--and they are primarily focused on the other person and not on toys or other aspects of the environment. Mueller and Lucas suggest that this transition is facilitated by imitation, or more precisely, by being imitated. For example, one child may perform an interesting action with a toy while being watched by a peer who subsequently may imitate that behavior. So far, there is no deliberate social interaction. However, if the first child observes his or her behavior being imitated and associates that contingent event with the original action, then the first child may discover that his or her behavior influenced the other child (and it was accomplished at a distance, without touching the second child). Once such a discovery is made by the child, the original behavior may be repeated (a type of social secondary circular reaction) or it may be altered in form (a type of social tertiary circular response), but with a goal of observing what influence or consequence such an action will have on the other child. Thus, Mueller and Lucas (1975) described 12- to 18-month children who engaged in reciprocal imitative acts which are followed by a pause during which the actor observes the possible consequences the action may have on the other child. The present study attemp-

ted an experimental test of these naturalistic observations.

Experiment 5: Being Imitated and the Development of Social Cognition

We propose that young children are more likely to cognize in some sense that their actions produced a social consequence if that consequence is identical in form to their own action than if that consequence is equally contingent but not identical in form to their original action. That is, being imitated provides the child with a consequence which is more likely to provoke behavior that implies the child possessed the social cognition that, "I influenced that person at a distance," than if the social partner had displayed an equally interesting alternative behavior but one dissimilar to the first child's original act. The experiment consisted of presenting 15-, 18-, and 24-month infants with a pair of toys. A target behavior had been pre-established for each toy. When the infant first displayed one of the two target behaviors, the examiner, who was sitting across from the infant with an identical pair of toys, either imitated the infant's behavior or displayed the alternative target (which the infant had not yet performed) with the other toy.

The purpose of the study was to discern whether the perception of being imitated leads to more social influencing behavior than the perception of contingent but nonimitative responses from another person. What, then, shall be the dependent measure of social influencing? We reasoned as follows. Suppose the child performs one of the target behaviors and the examiner imitates it? The child then either repeats the action or tries an alternative act followed by a pause to observe

whether the experimenter again performs a contingent action. Thus, if an infant performs an act following being imitated and then pauses to observe whether the experimenter again responds to that act, presumably with the expectancy of eliciting another contingent response, one might infer that the infant possessed the expectancy that their original action influenced the behavior of the examiner.

The general prediction was that infants who see themselves imitated should manifest more pause/looks than those who observe contingent responses from the examiner that are qualitatively different from their own behavior. However, this general prediction might be qualified, depending upon the nature of the social cognition mediating the pause/look behavior. For example, if the pause/look simply represents an anticipatory response and not an independent cognition, one might expect that (a) even young infants would be capable of such actions, as demonstrated in the conditioning literature, and (b) the difference between the imitation/alternate conditions should decline with age because older subjects are capable of making the association between their action and the examiner's even when the two behaviors are identical. Therefore, the difference between the imitation/alternate conditions should be a linear decline with age.

Conversely, if one assumes that a truly independent social cognition mediates the behavior, the prediction is slightly different. Theory (McCall, Note 10; Piaget, 1951) and data (McCall et al., 1977; Uzgiris, 1976) suggests that independent cognitions do not occur with great frequency before 13 or 14 months of age. Therefore, one would

expect the difference between the imitation/alternate conditions to be modest at 15 months, reach a maximum at 18 months, and decline by 24 months (when infants are capable of inferring the cause-effect relationship without an imitative consequence and probably would not find such an event of special interest). Therefore, one would predict a quadratic, not a linear, interaction between age and experimental group (imitation/alternative) with a maximum difference at 18 months.

Method

Subjects

Subjects were recruited in the same manner as described for Experiment 2. A total of 8 males and 8 females at each of 15, 18, and 24 months comprised the final sample. The actual ages of the three groups were 64.7 weeks (standard deviation equals 1.37), 79.3 weeks (2.59), and 106.3 (2.96) weeks of age. The distribution of siblings, parental age, parental education, and other demographic characteristics were similar to previous samples. An additional 10 subjects were seen but did not complete the session either because of fretting or because they did not display six target behaviors during the assessment (see Procedure).

Materials and Procedure

Materials. In previous studies, toys were selected for which a relatively unique behavior not likely to be spontaneously displayed by an infant could be specified. In contrast, the materials in this study were selected because infants would display one specific action with

the object. This was necessary because children were to play with the toys until they spontaneously displayed the pre-established target behavior. The toys were either commercially available or ones used in previous studies. They were put into pairs such that the objects in a pair were a priori thought to be relatively equivalent in their interest value. Table 18 presents brief descriptions of the toys as well as the pre-established target behaviors, and Figure 16 photographically presents these objects.

Insert Table 18 and Figure 16 about here

Procedure. The observation was conducted in a large mobile laboratory parked at shopping malls in the Dayton and Springfield, Ohio, areas. While the observations were being explained to the parent and consent obtained, the warm-up period for the child began. A Slinky, Ladybug, and a Rock-n-Stack were located on the floor, and the child was told that he or she could get down from the parent's lap and play. An E sat on the floor and played with the objects as an enticement to S. If the child did not contact a toy within 3 min., the E handed the Slinky to S. The warm-up session lasted a minimum of 5 and a maximum of 15 min. or until the child played freely with the toys and participated in toy exchanges with E.

The assessment phase began thereafter at a table. The E sat opposite to the child and the mother was lateral and to the rear of S. E presented pairs of toys to both S and herself in one of two

Table 18. Toys and Target Behaviors for Experiment 5

1. Spinner - a red, green, yellow, and blue striped windmill-type spinning object mounted on a blue base. Target: Spins windmill object to make it go around.

   Box and Rattle - a green plastic box with a red wooden ball, attached to a piece of plastic clothesline, that made into a rattle. Target: Puts rattle inside box and shakes it around to make a noise.

2. Shaker - a plastic yellow cube with bells inside. Target: Shakes cube to make sound.

   Keys - several green, pink, and white plastic keys on a chain. Target: Shakes so that keys rattle.

3. Circle Shaker - a blue plastic circular object with bells inside that rattle when shaken. Target: Shakes to make noise.

   Car - a green jeep. Target: Manually runs car back and forth once.

4. Penguin - a black and white penguin with a plastic tube attached to a squeeze bulb that made the penguin open its mouth producing a sound. Target: Squeezes rubber bulb so that mouth opens and produces sound.

   Helicopter - a pull toy with a rotating propeller. Target: Moves the helicopter back and forth so that blade rotates.

5. Apple - a half red plastic apple with beads inside that made noise when shaken. Target: Shakes to make noise.

Table 18 (continued)

Drum - Playskool drum with a bone-shaped drumstick. The drum has a hole in the center in which the drumstick fits. Target: Moves drumstick up and down in the hole to produce a noise.

6. Xylophone - Fisher-Price Pull-a-Tune that could be hit with a mallet or pushed to produce a sound. Target: Hits with mallet to produce sound.

Train - red, blue, and yellow train engine that made sound when moved back and forth. Target: Moves train back and forth on table to produce sound.

7. Dog - Fisher-Price dog with movable ears and floppy tail that rolled back and forth on asymmetrical wheels making a noise. Target: Moves dog back and forth to make noise.

Ladybug - a red ladybug with spots that changed color when the toy was rolled back and forth producing a sound. Target: Moves ladybug back and forth to make noise.

8. Clown - an orange clown that squeaked when its nose was squeezed. Target: Squeezes nose to produce sound.

Squeekaboo - a Fisher-Price brown fuzzy hand puppet that rattled when shaken, had ears that squeaked when squeezed, and moved by putting fingers into little straps on the back of the ears. Target: Shakes to make noise.

9. Piano - a small grand piano with 12 keys and no legs. Target: Hits keys to make noise.

Table 18 (continued)

Bug - a red bug with green wheels that made noise when pulled. Target: Rolls bug back and forth on table to make noise.

10. Work Bench - Playskool cobbler's bench with 1 blue peg plus hammer. Target: Hits peg with hammer.

Hourglass - red and yellow hourglass with colored sand that shifted from end to end when the hourglass was inverted, producing a noise. Target: Shakes hourglass to make noise.

11. Music Spinner - Playskool red, yellow, and blue plastic circle mounted on an orange and cream plastic base that spun when touched making a musical noise. Target: Turns colored circle to make musical sound.

Music Rattle - yellow and orange plastic rattle that made a musical sound when shaken. Target: Shakes to make sound.

215

216

Figure 16

orders. Order 1 consisted of the order of the pairs presented in Table 18 while Order 2 was the reverse. As many pairs were presented as was necessary to achieve six useful items (i.e., ones on which S displayed a target behavior). As a result, the two orders not only imply different sequences but also different pairs of items, therefore contributing to the generality of these results across specific toy pairs.

Once a pair of toys was presented, the S had 2 min. to display one of the two target behaviors pre-established for the toys of that pair before the next pair of toys was presented. In order to permit the child some time to explore and to reach a small degree of habituation with the objects (presumably making S more attentive to E's behavior), the child was given 15 sec. of free play without the examiner responding to any target behaviors occurring during this initial period.

Following the 15-sec. free exploration, if S displayed the target behavior with either of the two objects, E responded immediately with one of two behaviors. In the imitation condition, the E duplicated the target which the child displayed. From S's standpoint, the E imitated S's action. In the alternate condition, the E responded equally contingently but performed the pre-established target behavior associated with the alternate object--the object with which the child had not displayed the target behavior. From S's standpoint, the E performed a contingent behavior with the other object in the pair of toys. Across subjects, target behaviors with each of the two objects were spontaneously displayed, and thus the specific target behavior

was balanced to a certain extent with experimental condition (i.e., imitation/alternate).

Following E's performance the subject was permitted to have one sustained play episode with either toy of the pair, where a sustained episode was terminated when the S ceased to contact the toys for at least 3 sec. or switched from the toy with which the episode was initiated.

Dependent variable. When the sustained play episode following E's behavior was terminated, the one dependent variable of this experiment was assessed. A pause/look occurred when the S terminated the sustained play episode by ceasing to manipulate the toy (whether released or not) and looked at the experimenter or the experimenter's toys during that pause. This variable was scored as either having occurred or not occurred by an observer who sat behind a one-way window at the side of the table with a clear view of S and E. Interobserver reliability for this variable summed over the six trials per S was obtained on a nonsystematically selected subsample of 28 subjects using the E as the reliability coder. The reliability was .74, and the two observers were within one point of each other in 90% of the cases. Given that the reliability coder--the E--had a great deal to do during the experiment (e.g., vigilantly observing the S's behavior, moving four toys off the table and another four on to the table at each item change, etc.) and the fact that E had to remember which of the six usable items (a subject could have up to 11 item presentations) had been accompanied by a pause/look, we regard this reliability as a minimum estimate.

Results

The data were analyzed from the standpoint of one prediction and the evaluation of another possible effect. The prediction made above, stemming from the assumption that an independent social cognition mediated the behavior of the Ss, was that there should be a quadratic interaction between age and experimental condition (imitation/alternate) in which the imitation condition should produce more pause/looks than the alternate condition at the young ages, reaching a maximum difference at 18 months. Another possible effect was that subjects would learn the experimenter's contingent behavior across the six trials, and consequently either increase the number of pause/looks in the course of exploring this contingency or decrease the number of pause/looks as a function of habituation to the contingency. The latter effects might covary with age. Therefore, a Sex x Age x Experimental Condition (imitation/alternate) x Trial Blocks (items 1-2, 3-4, and 5-6) analysis of variance was conducted on the number of pause/looks with the quadratic component of the Age x Experimental Condition interaction predicted to be significant.

The predicted quadratic interaction was significant, $F(1,36) = 4.15$, $p < .05$, and the plot of this interaction is presented in Figure 17. In

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Insert Figure 17 about here

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accord with the prediction, the imitation group evidenced more pause/looks at 15 and at 18 but not at 24 months than the alternate group with a maximum difference at 18 months. A priori simple effects tests indicated that the difference between the groups was significant at 18 months, $F(1,36) = 4.17$, $p < .05$, but not at the other ages.

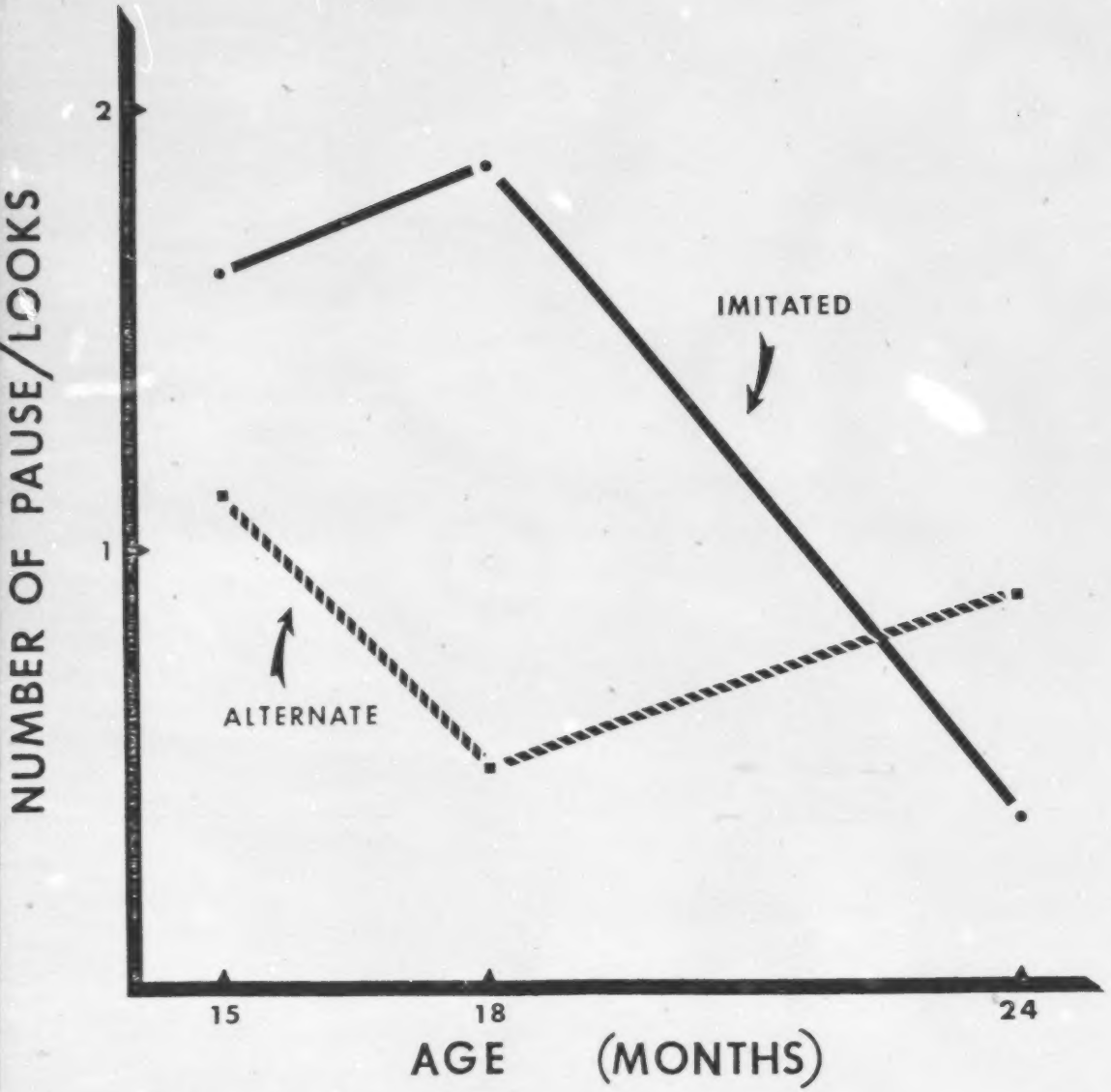
NUMBER OF PAUSE/LOOKS
2
1
IMITATED
ALTERNATE
15
18
24
AGE (MONTHS)

Figure 17

No other effects in the analysis including the main effects and interactions for the blocking factor were significant. Thus, there was no evidence of learning or habituation within the experimental session.

Discussion

This experiment demonstrated that the sight of being imitated is more likely associated with the subsequent behavioral sequence of action/pause/look-at-E among young infants than the sight of an equally contingent but dissimilar action by E. Conceptually, being imitated is more likely to lead to anticipatory social behavior than is being responded to with a qualitatively different action.

The intent of this study was to explore the possibility that reciprocal imitation games between parent and child or among peers during the second year of life might function to facilitate the development of social behavior. The data are concordant with this speculation, indicating that being imitated may play such a role in the first half of the second year; but by two years of age, cognitive abilities have developed sufficiently so that being imitated is no longer more powerful in this regard than the perception of any contingent social behavior, imitative or otherwise.

The demonstration that a given behavioral event or cognition is acquired in naturalistic circumstances in a prescribed manner is essentially impossible (McCall, 1976-a; Wohlwill, 1973). One can show under controlled conditions that it is possible for circumstance X to produce behavior Y, but that fact alone does not prove that the X-Y causal

relationship operates in naturalistic settings--it could, but does it? Alternatively, one could observe in ecologically valid environments that X is typically followed by Y, but correlation does not prove causality. If both these facts obtained, one would be prone to conclude that the naturalistic development of Y is causally influenced by X, but that conclusion is an inference and not conclusively proved even by the joint occurrence of such observations.

In the present case, these data represent a demonstration that being imitated could serve the function of promoting the social influencing of another person at a distance. The structured, quasi-naturalistic observational data of Mueller and Lucas (1975) prompt the belief that peers do socially explore one another by reciprocal imitation, but there are no other data known to the authors that show reciprocal imitation games between parent and child actually do play this role in naturalistic settings. Therefore, accepting these data at their face value, we have evidence that being imitated could be especially functional in promoting early social behavior, but at this point we are not certain that it actually does serve this function in naturalistic contexts.

This experiment also represented a weak test of the nature of the social cognition mediating such an effect. It was presumed that if no special cognition was required for the pause/look behavior to occur in this context, it should be fully displayed even by the 15-month subjects, because anticipatory responses are commonly reported

in the conditioning literature at much younger ages. However, if an independent social cognition that "I had an influence at a distance" mediates the pause/look act, then other data suggest that such an ability should be only modestly present at 15 months but be more mature by 18 months. Both positions assume that by 24 months infants could infer the social contingency in either experimental circumstance (i.e., imitation/alternate). The data favored the interpretation that being imitated facilitates the development of an independent cognition of social influence at a distance.

However, one must acknowledge the tenuousness of the above conclusion. First, the pause/look act possesses no particular empirical history and therefore no research-based construct validity in this regard. Second, although anticipatory responses can occur much earlier than 15 months, such literature does not necessarily compel the belief that pause/looks should occur anticipatorily in the present context. Other factors not relevant to these conceptual issues might suppress their manifestation at 15 months in this situation. Third, the quadratic interaction observed in Figure 17 was produced in part by the drop in pause/looks by the subjects in the alternate condition at 18 months, a result that was not predicted and not easily explained. The predicted result should have been produced by a dramatic rise in the curve for the imitation condition at 18 months, which result is perceptible in Figure 17, but barely so. Therefore, while these data are consistent with the theoretical speculation that a

social cognition of distance influencing emerges during the second year of life and may be promoted by reciprocal imitation experiences, they are not thoroughly compelling of that conclusion. In any case, these data encourage further research into the cognitive associates of early social behavior.

CHAPTER V. CONCLUSIONS AND IMPLICATIONS

The data presented here confirm and extend our knowledge of imitative behaviors in children 1-3 years of age with respect to the stimulus parameters of the target behavior, the limiting role of cognitive development, the possible existence of a trait of imitativeness, the role of imitative experiences in social development, and the potential of young children to imitate televised models.

Live Models

Details of the results of these studies have been given at the ends of Chapters II-IV. A general summary integrated with the literature on imitation in older children follows.

Parameters of Imitation

The target stimulus. The rate of imitation and its developmental course depend upon the nature of the target stimulus. Consistent with previous findings (Paraskevopoulos & Hunt, 1971; Rodgon & Kurdek, Note 7; Uzgiris, 1972), gestures were imitated more frequently than vocalizations. However, simple motor acts were imitated more than several types of behaviors (including vocalization) each of which required direct social interaction with the examiner. Therefore, a general distinction based upon the social requirements of the target behavior may encompass the gestural/vocal dichotomy.

Simple single-unit behaviors are imitated more readily during the second year than coordinated sequences of two or more behavioral elements (Webb & Massar, Note 5).

Age. It appears that the ability of an infant to translate a perception of a simple behavioral event into their own actions is present before 12 months (the youngest age tested in this project). This conclusion is inferred from the fact that infants did not approximate target behaviors--imitation was essentially perfect or not attempted at all. Moreover, this ability must exist in some form even in the first few weeks of life, because responses already in the infant's repertoire can be facilitated at these ages (e.g., Abravanel et al., Note 4; Maratos, Note 1; Moore & Meltzoff, Note 3). Novel behaviors are probably not imitated until approximately 7-8 months (McCall et al., 1977; Piaget, 1951; Uzgiris, 1972, 1976).

Although we conclude that year-old infants are capable of translating a perceived event into their own action, they do not always do so. Imitation of simple motor acts increased from 28% to 76% between 12 and 24 months, and imitation of behaviors requiring more direct social interaction with the examiner (a stranger) rose from 21% to 45% across the same period--despite the fact that the precision of imitation remained essentially constant.

Other factors. No consistent effects were observed for the sex of the infant, the education of the parents, the presence or age of siblings, the particular examiner or test form, or the degree of social apprehension displayed by the subject before testing. However, 18-24-month subjects imitated slightly more in a deferred play session if they had been told by the model to do so than if they had not; the opposite was true

for 36-month subjects. Moreover, children whose parents described them as being attentive and not shy of adults or imposing toys imitated slightly more than other children.

These data suggest noncognitive variables, perhaps motivational or social, may be involved in the developmental course of imitation as well as in producing individual differences. Research with older children implicates the status, sex, and familiarity of the model, the complexity and interest value of the modeled behavior, and the incentive delivered either to the model and/or the viewer (Bandura, 1969, 1971; Thelen, 1974). But, because of the toddler's limited cognitive ability and restricted experience, findings based upon older children probably cannot be simply extrapolated downward to apply to 2-3-year-olds without qualitative modification.

A Trait of Imitativeness

A trait of imitativeness prior to approximately 20 months is not supported by these and other data (Abravanel et al., Note 4 ; Rodgon & Kurdek, Note 7; Webb & Massar, Note 5). The correlations across target behaviors at a single session were quite weak, although behaviors that produced clear and pronounced stimulus consequences tended to cluster together as did those that engendered more muted effects. Moreover, while individual differences in the propensity to imitate displayed increasing stability across a month or two during the second year of life, correlations spanning periods of three months or longer were essentially zero.

In contrast, Rodgon and Kurdek (Note 7) found a sizable correlation among 20-month infants between the likelihood of imitating sounds and word combinations and spontaneous vocabulary. In one study reported herein, correlations across two types of deferred imitation were found for items involving a coordinated sequence of behavioral elements for 24-month subjects. Therefore, some generality of imitativeness may occur when the behaviors require symbolic relations.

Imitation and Cognitive Development

Piaget (1951) emphasized the intimacy between cognitive development and the ontogeny of imitative behaviors. Our data are consistent with several of his formulations.

Other research indicates that imitation during the first months of life is largely social facilitation of extant schemata (i.e., "pseudo-imitation"). Imitation of novel stimuli may emerge as a byproduct of means-ends differentiaion at approximately 7-8 months (Abravanel et al., Note 4; Hursh & Sherman, 1973; Litrownick, 1972; Webb & Massar, Note 5; Uzgiris, 1972, 1976). Contrary to Piaget's assertion, behaviors which the infant could not see himself perform (e.g., tongue protrusion; called "incomparable feedback" herein) are present in the first weeks of life (Brazelton & Young, 1964; Gardner & Gardner, 1970; Lyakh, 1968; Maratos, Note 1; Moore & Meltzoff, Note 3), but such behaviors were imitated with lower frequencies than simple observable motor actions throughout the second year (Abravanel et al., Note 4). However, this effect may not be due to the inability to monitor the feedback from one's own action but the facts that such behaviors (a) tend to be movements without objects which

are known to be imitated less than movements with objects (Abravanel et al., Note 4; Rodgon & Kurdek, Note 7; Uzgiris, 1972) and (b) require direct interaction with the examiner which was also associated with low rates of imitation.

Piaget's (1951) theory plus recent data by McCall and Uzgiris (McCall, Note 10;McCall et al., 1977; Uzgiris, 1976) prompt two other hypotheses borne out by the current data. First, if the infant is not capable of forming relations between two external entities without directly acting on them until after approximately 13 months, then infants should not be able to imitate a coordinated sequence of two novel behavioral elements until this age--perhaps later, if imitation itself imposes additional cognitive demands on the infant. In contrast to the linear increasing probability of imitating a single-unit behavior between 12 (28%) and 24 months (76%), the imitation of a coordinated sequence of two behavioral elements was essentially absent through 15 months, rising thereafter to 24% at 18 months and 59% at 24 months in accord with these speculations.

Second, Piaget (1951) claimed that imitation deferred until long after modeling was a sign of the presence of the symbolic function, which has been suggested to emerge in certain forms at approximately 21 months (Flavell, 1976; McCall, Notes 9 and 10; McCall et al., 1977). Consistent with this expectancy, deferred imitation, either in the same context as original testing with the examiner present or in a free-play session with the examiner absent, did not occur in our data with any

substantial frequency until 24 months of life. Deferred imitation of coordinated sequences, in contrast to single-unit behaviors, appears to emerge even later.

Therefore, it is plausible to assume that the imitation of coordinated sequences and the deferred imitation of single and multiple-unit actions must await the infant's advance toward entity-entity cognitive relationships and the symbolic function, respectively. However, studies more directly comparing advances in cognitive skills and imitation assessed in standardized testing and more ecological contexts (e.g., peer-peer interactions) are needed. Moreover, investigations of older children (e.g., Bandura, Grusec, & Menlove, 1966; Bandura & Jeffrey, 1973; Bruner, Olver, & Greenfield, 1966; Coates & Hartup, 1969; Gerst, 1971; Kreutzer, Leonard, & Flavell, 1970; Zimmerman & Rosenthal, 1974) suggest more focused studies on deferred imitation, especially the possible role of spontaneous rehearsal and imaginal and verbal coding processes in spanning the retention interval at different developmental levels.

The Role of Imitation in Social Development

The final study in this series demonstrated that infants who saw themselves being imitated were more likely to attempt to influence the imitator than if that person had not imitated the child but performed some other behavior in an equally contingent manner. This difference was especially true at 18 months, an age positioned between the onset of entity-entity relationships (approximately 13 months, McCall et al., 1977) but before symbolic relations, skills which would permit the infant to draw

an infenrece of having influenced the partner even from their nonimitative contingent behavior.

These data make plausible the hypothesis that the observation of being imitated could constitute an experience that is especially conducive to promoting the social cognition that "I had an influence on that person," a conception that opens the door to flexible and mature social relations. Indeed, Mueller and Lucas (1975) came to the same conclusion on the basis of their observations of peer-peer social behavior during the second year of life. If the experience of being imitated fulfills this function, then more investigations are needed to describe the frequency, age distribution, and temporal patterns of different types of reciprocal imitation experiences that infants receive with parents, siblings, and peers in naturalistic settings. In view of the potential power of experience or lack of experience with inanimate contingent events for infant learning and social development, research into social contingencies (imitative and otherwise) would seem especially fruitful (Finkelstein & Ramey, 1976; Hollenback, 1976; Jones, Gergen, & Jones, 1963; Seligman, Lewis, & Goldberg, 1969; Watson, 1972; Watson & Ramey, 1972).

Televised Models

Live Versus Televised Models.

Before their second birthday, infants may not attend as persistently to televised as to live models, but this will certainly depend upon the specific material presented. Moreover, given that the model is watched,

infants are more likely to imitate a live than a televised model immediately after the modeling, but this difference diminshes with age and is probably absent after three years of age. However, in terms of deferred imitation (a situation more comparable to home television viewing), no difference in imitating live versus televised models occurred. This result may indicate the special salience of live adult human to young children, because the examiner was present during immediate but not during deferred imitation.

The results on the differential power of live versus televised models to recruit attention of infants under three years of age points to further research on the parameters of attention to televised material by toddlers. Hollenbeck (1976) investigated the general impact of the visual and auditory modalities of televised stimuli, and research with older children demonstrates that the amount of action, the proportion of verbal material, the amount of background music, camera perspectives, and the reactions of co-observers can influence attention and learning (Hicks, 1968; Poulos, Rubinstein, & Liebert, 1972; Salomon, 1972; Singer & Singer, 1976). The factors considered in the planning of Sesame Street (Palmer, 1972) suggest additional hypotheses.

Similar to the live model conditions, imitating a televised model failed to correlate with the sex of subject, education of parent, presence and age of siblings, or amount of television viewing reported by the parent. In contrast to live models, there were no effects on television imitation for child temperament as reported by the parent or for instructions to imitate.

Implications

The data clearly show that children between two and three years of age are capable of imitating a televised model, and the rate of imitation does not diminsh even after a 24-hour delay is introduced. Prior to two years, infants are able to imitate a televised model, but they are less capable of deferring imitation or reproducing sequences of behavior. Because of these restrictions,relativel, little imitation can be expected from home television fare prior to 18-24 months under current naturalistic circumstances. However, if an infant sees a particularly captivating event that involves essentially a single action and the objects involved in the act are present in the viewing environment, immediate imitation could occur at much younger ages.

In contrast to the imitation of live models, the imitation of televised material seems to be a less social event even for 18- to 36-month children. That is, the temperament of the child and instructions to imitate, which related to the imitation of live models, were not influences on the imitation of televised models. Many professionals have commmented on the asocial character of television watching and that excessive viewing habits may promote unusual passivity in the child. These data provoke the hypothesis that by the time the child is old enough to imitate substantial numbers of actions seen on children's programming, television viewing and subsequent imitation are already defined in some sense by the child as less social events than corresponding activities with live individuals.

The failure to observe a relationship between the amount of home television viewing (as reported by the subject's parent) and the propensity to imitate implies that excessive viewing may not have direct effects on the child's tendency to imitate televised actions prior to 36 months. However, protracted television viewing was not common in this sample, and it could lead to a variety of consequences not investigated in this report.

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Figure Captions

Figure 1. Objects used as the imitation items in Experiment2 and described in Table 6. From left to right, top to bottom, in the top frame--motor with object set (rocking block, rectangular block, ring of spools), motor with form product set (Teddy bear with rings, crayon, puzzle), motor with sound product set (cord and can, ring and box, small cans), coordinated motor sequence set (brass cup and rod, cube and nesting blocks, metal rings and block); in the bottom frame--vocalization set (telephone, car, bunny), incomparable feedback set (sponge; screen not shown), and social set (foam ring, teeter-totter).

Figure 2. Mean original target scale score for each category plotted across age.

Figure 3. Percent perfect imitation, approximate imitation, and no imitation for the motor cluster, social cluster, and coordinated sequences plotted as a function of age.

Figure 4. Percent perfect imitation during the five assessment phases plotted as a function of age.

Figure 5. Percent perfect imitation of the motor cluster, social cluster, and coordinated sequences during the differential and repeat original target phases plotted as a function of age.

Figure 6. Percent perfect imitation (left) and percent approximate imitation (right) during the deferred phase for the motor cluster, vocal cluster (excluding social and incomparable feedback), and coordinated sequences plotted as a function of age.

Figure 7. Percent perfect imitation across all items for the longitudinal sample plotted as a function of assessment phase and age.

Figure 8. Percent perfect imitation for the motor cluster, social cluster, and coordinated sequences during the original target, differential, and repeat-original-target phases of the longitudinal study plotted as a function of age.

Figure 9. The original and transformation stimuli used in Experiment 3 and described in Table 11. From left to right, top to bottom, in the top panel--puzzle, animals, coil, ring and box, slide and golf ball; bottom panel--rocking block, bell-block and dowel (transformation not pictured), doll (blanket and transformation not pictured), pinwheel, nesting sponges (one semicircular sponge not pictured), springboard with ring, and spinner (sheep and pig not pictured).

Figure 10. Percent of item observations on which subjects attended to a complete modeling of the target behavior plotted across age as a function of live versus TV models.

Figure 11. Mean imitation scale score (4-level) during immediate assessment plotted across age as a function of live versus TV model.

Figure 12. Mean minutes playing with objects for items on which the subject saw a complete modeling plotted across age as a function of live versus TV model.

Figure 13. Mean imitation scale score (4-level) during the deferred play session plotted across age as a function of instruction condition.

Figure 14. Toys used as stimuli for Experiment 4 and described in Table 17. From left to right and top to bottom--the big mouth singers, doll and tea set, knocky, car and slide, broom-dustpan-basket (broom and dustpan not pictured), large building block (only one of the four is pictured), and the busy driver.

Figure 15. Mean imitation score (3-level) per item as a function of whether the item was modeled or not modeled and as a function of immediate versus delayed assessment. Only items for which a subject saw the complete modeling are included in the data for the modeled condition.

Figure 16. Pairs of toys used in Experiment 5 and described in Table 18. From left to right, top to bottom--spinner, box and rattle; circle shaker, car; penguin, helicopter; shaker, keys; dog, ladybug; clown, squeekaboo; drum, apple; xylophone, train; piano, bug; music rattle, music spinner; and hourglass, workbench.

Figure 17. Mean number of pause/looks as a function of age and whether the E imitated the child's target behavior or performed an alternate, nonimitative action.